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THE GAS JOURNAL

OCTOBER 14, 1931

A Glance at the Contents—

Engineer and Manager Required.

The Farnworth and Kearsley Gas Company require an Engineer and Manager. The salary offered is £375 per annum rising to £400 by two annual increments. [p. 161.]

Deputy Gas Engineer Required at Bradford.

Applications are invited for the position of Deputy Gas Engineer to the Bradford Corporation. The salary attached to the post will be from £575 to £750 per annum, and applicants must have experience in construction and management of works and the control of men. [p. 162.]

Michael Faraday and the Gas Industry.

This is the subject of a letter by Mr. W. A. Voss in our Correspondence columns to-day. Mr. Voss writes in connection with Sir David Milne-Watson's reference before the British Association to Michael Faraday's close connection with our Industry and gives some interesting additional facts. [p. 130.]

Further Potential Gas Investments.

Extracts from the "Financial Times" "Potential Investments" columns include particulars of a number of large Metropolitan and provincial gas companies. This week the following companies are featured: South Metropolitan, South Suburban, East Surrey, Bournemouth, and Cheltenham. [p. 134.]

Presidential Address of David N. Garrie.

We publish to-day extracts from the Presidential Address of Mr. David N. Garrie before the Scottish Junior Gas Association (Eastern District). Mr. Garrie calls attention to the fact that this Association has now the undesirable distinction of being the only unit outside the British Junior Gas Association. [p. 154.]

Opening Meeting of Midland Junior Association.

There was a large attendance at the opening of the session of the Midland Junior Gas Association at the Gas Department, Council House, Birmingham, on Thursday, Oct. 8. Mr. W. Macnaughton, Wolverhampton (retiring President), occupied the chair at the opening of the meeting. Subsequently, the new President, Mr. W. L. S. Spinks, of Birmingham, took the chair, and delivered his Presidential Address. [p. 152.]

Future Possibilities of Fuel Utilization.

Speaking on this subject before Section B (Chemistry) of the British Association, on Sept. 28, Mr. H. T. Tizard, of the Imperial College of Science and Technology, remarks that British coal is pre-eminent for its high quality—but high quality is not essential for the production of electricity. There is only one obvious direction which might achieve substantial results in fostering the export trade. We must take a fresh view of the Gas Industry. It is in the cheapening of gas that he sees the most hopeful means of checking the real competition of oil, and of giving a new impetus to the coal export trade. [p. 137.]

Lancaster Wants Gas Engineer.

As will be seen from our advertisement columns, the Lancaster Corporation invite applications from qualified engineers, not exceeding 45 years of age, for the post of Gas Engineer at a commencing salary of £650 per annum, rising by annual increments to a maximum of £800, *plus* free house, rates, fuel, and light. [p. 162.]

The British Fuel Problem.

Sir David Milne-Watson, in a paper read at a meeting of Section B (Chemistry) of the British Association, on Sept. 28, said that carbonization of coal is almost entirely confined to two industries—the Gas Industry and the coking industry. Each industry treats some 18 million tons of coal per annum, or 36 million tons in all. [p. 136.]

Hydrogenation of Coal.

We publish an extract of a paper entitled "Coal: Smokeless Fuel and Oil from the National Standpoint," which was presented by Dr. W. R. Ormandy at a joint meeting of the Institute of Fuel and allied organizations, including the Institution of Gas Engineers, on Wednesday last. The author deals extensively with the hydrogenation of coal and coal tar. [p. 140.]

North of England Association.

In the course of his Presidential Address before the North of England Gas Managers' Association on Oct. 9, Mr. J. R. Bradshaw, Engineer, Manager, and Secretary of the Hartlepool Gas and Water Company, urges greater co-ordination in the Industry and suggests the advisability of defining and limiting the scope of each of the many organizations at present existing. [p. 144.]

Manchester District Institution.

An Ordinary General Meeting of the Manchester District Institution of Gas Engineers was held on Friday, Oct. 9, at the new Gas-Works, Lostock, Preston. There was a large attendance of members, who, during the morning, were taken in parties through the works and inspected the plant. They were received by Mr. Walter Davies, a Director of the Company, and by Mr. S. Tagg, the Engineer and Manager. The members were subsequently entertained at luncheon. [p. 148.]

The New Gas Industry.

In a paper before Section G (Engineering) of the British Association on Sept. 29, Sir David Milne-Watson gave some comprehensive figures on the Gas Industry. The progress in recent years of the Industry, concluded the paper, shows a bright outlook whether in regard to its gaseous or solid products. Its activities are rich in scientific endeavour, and incorporate the very finest methods of affording service to its clients. Its experience both at home and abroad demonstrates its ability to meet its competitors on a fair field, be they electricity, oil, or coal. The Gas Industry to-day is virile, scientific, modern, and progressive. [p. 138.]

EDITORIAL NOTES

Hydrogenation

RECENT months have witnessed a growing interest in the question of hydrogenation of coal and coal oil, and many pronouncements have been made by Imperial Chemical Industries. Throughout we have in the "JOURNAL" endeavoured to give our readers a straightforward account of all these developments, and to keep them informed, in particular, of the relative merits of hydrogenation of coal oil and of raw coal. From the point of view of the carbonizing industries, it seems obvious enough that the greatest benefit would lie in the hydrogenation not of coal itself, but of the oils produced by carbonization either at high or at low temperatures; it is also obvious enough that Imperial Chemical Industries favour the direct hydrogenation of coal, in spite of experience in Germany. Or, perhaps it would be more courteous to say, because of their experience of two years' working of a 15-ton per day plant at Billingham. Anyhow, last Wednesday, in a discussion following a paper by Dr. W. R. Ormandy at a joint meeting of the Institute of Fuel and allied organizations, including the Institution of Gas Engineers, Mr. K. Gordon, Director of the coal-oil plant at the Billingham Works of I.C.I., gave his answers to three questions.

The first was whether we should hydrogenate coal or tar made from coal. Briefly, his answer to this question was that tar available or likely to be available at £2 a ton should be hydrogenated, but that the main volume of our home-produced fuel should be made direct from coal; and he made the point that a plant designed to hydrogenate coal could treat tar as well, while the converse would not be possible. Secondly, to the query whether the process is sufficiently advanced for its immediate development on a large scale, he replied: "We can say confidently that we are technically ready to build a plant of whatever size we like, and that when built that plant will operate in accordance with planning." And he estimated the cost of a 1000-tons of coal a day plant (producing 210,000 tons of petrol per annum, equivalent to 8 p.ct. of our present total petrol consumption) at £8,000,000. His answer to the question as to what the cost of production would be was that the cost of petrol made by such a plant, including obsolescence, would be 7d. a gallon; and he maintained that at this price petrol can be retailed at the present market price of petrol after allowing for retailer's profit, cost of distribution, and a reasonable return on the capital invested in the hydrogenation process.

That the question of hydrogenation is of national importance, no one will deny; and it closely affects the carbonizing industries. In our extract of Dr. Ormandy's paper, the following phrase occurs: "Assuming that the motor spirit produced by hydrogenation from coal [*i.e.*, by the plant proposed by I.C.I.] were not taxed, then under the present conditions the State would lose £1,750,000 in duty, but an additional 900,000 tons of coal would be necessary, which would find employment for 3000 additional miners, and obviously the provision of the necessary plant would find temporary work for many more." Now there is another point of view, surely of national importance. There is a cry for smokeless fuels; and carbonization is the method to produce them. The advantages to the nation of replacing raw coal by either gas or coke are well enough appreciated by our readers to render it unnecessary to detail them here. Replacement of raw coal, though it might not materially affect employment in the mines immediately, would effect enormous economies in civic expenditure, would enhance health, and would conserve national resources. Tars in greater quantity would be produced; and if these tars, instead of raw coal, were subjected to hydrogenation, the nation would, of course, become more self-supporting. We hope that, in any consideration of hydrogenation, this aspect of the matter will not be lightly dismissed. Also, in discussing hydrogenation, sight should not be lost of the fact that hydrogenation does not necessarily imply the production of petrol; heavy oils can be produced by hydrogenation just as easily as the more volatile qualities.

"An Insurance for the Future"

FURTHER views on the hydrogenation of coal—views very definitely expressed—are to be found in our issue to-day. At the British Association meeting, Mr. H. T. Tizard, Rector of the Imperial College of Science and Technology, discussed the future possibilities of fuel utilization. In regard to hydrogenation, he emphasizes that we do not want a repetition of the financial history of low-temperature carbonization; and he "regards with scepticism" any figure under 9d. per gallon for the cost of petrol produced by hydrogenation of coal. On this basis, Mr. Tizard argues that, though we can produce by hydrogenation motor fuel at a price not prohibitive to the road transport industry, there is no present likelihood of being able to produce it in open competition with petrol from natural sources. "The process could only be established on a large scale in this country under the protection of a tax which would virtually exclude for many years the competition of natural oil. My opinion is that this would be an economic mistake of the first order." But after further comments, the author does observe that we can rightly regard the hydrogenation process as a valuable insurance for the future.

Our readers will be interested in two further views, equally definitely expressed by Mr. Tizard. The first is that domestic heating on a large scale by means of electricity should be discouraged in the national interest. Here is what he says about the matter: "It would be a gross, and quite unjustifiable, waste of national resources. The fact that electricity is sold at artificially low prices for domestic heating should not delude anyone into thinking that such prices could be maintained if the heating load ever became high. There is definitely no possibility that domestic heating on a large scale by electricity can be effected as cheaply as by gas." The second view concerns low-temperature carbonization. He thinks that as a self-contained commercial enterprise on the large scale, low-temperature carbonization must be regarded as dead; that it may yet find, in a modified form, a useful place in conjunction with existing gas undertakings, but that it has ceased to be of outstanding national importance. "The domestic heating problem," he concludes, "can be, and is being, most satisfactorily solved by the normal developments of the gas undertakings."

The fact is beginning to be realized that a satisfactory smokeless solid fuel can be produced at high temperatures of carbonization by the Gas Industry. Reference to this is made by Dr. Ormandy, who devotes much attention to the part which our Industry is playing in the production of household smokeless fuel. We gather from his paper that he regards the problem before the Gas Industry as a straightforward one: Carbonize cleaned coal; regard 8 p.ct. of ash in the coke as a maximum; sell the coke in a dry state; and pay attention to its correct grading, ease of ignition, and density. His remarks in this connection are well worthy of study.

A Sound Position

WHILE it is natural that gas debentures and preference stocks should have suffered some marking down in sympathy with other fixed-interest securities, ordinary gas stocks have, as pointed out in our Stock Market Report last week, remained unaltered, with few exceptions, throughout the present crisis. As an illustration of the consistent steadiness of ordinary gas stocks, a table of comparative quotations of some of the larger issues with those ruling on the same date for the past two years was published on p. 92 of last week's "JOURNAL." No one taking an interest in stocks and shares generally will need to be reminded of the unsatisfactory nature of these two years; but it is seen that small depreciation has occurred in the values of ordinary gas stocks. On several occasions in these columns attention has been drawn to the outstanding steadiness of gas stocks during the "slide" in the shares of so many industries which was more or less continuous following upon the weakening of public confidence that began with the Hatry crash. This is a good talking point, for there are still an amazingly large number of people who regard the Gas Industry as "tottering to its fall." One's own opinions upon the matter might be regarded as biased, but no such accusation can justly be levelled at the "set fair" barometer of the Stock Exchange.

Official Statistics

IF the evidence of the Stock Exchange is not enough, then doubters may be referred to the Board of Trade Return relating to all authorized gas undertakings in Great Britain, for the year 1930, which was issued a few days ago by H.M. Stationery Office, Adastral House, Kingsway, W.C., at the price of 4s. net. This is the first part of the Return, and includes the working figures; financial statistics are dealt with separately, and are usually published some time later. Now, 1930 was not by any means a favourable year, and having regard to bad trading conditions some falling off in the business of so well developed an industry as the Gas Industry was naturally to be expected. It is, however, seen from the Return that the quantity of gas made (including gas bought from coke ovens) during 1930 was 3373 million c.ft., or 1·1 p.ct., less than the quantity made in 1929, while the quantity sold was less by only 2607 million c.ft., or 0·9 p.ct. In the circumstances, these figures may fairly be regarded as satisfactory, though that is not to say that we have any other feeling than complete confidence that they will be handsomely improved upon with the advent of more propitious times. The difference between the decrease in the quantity of gas made (1·1 p.ct.) and in the amount sold (0·9 p.ct.) may be taken as showing an improvement of 0·2 p.ct. in the unaccounted-for gas figures.

Though, as already stated, there was last year a trifling falling off in the total sales of gas, from 292,598 million c.ft. to 289,991 millions, the amounts sold to prepayment consumers and for public lamps both show increases. The figures are: Prepayment consumers, 1929, 106,338 million c.ft.; 1930, 107,964 millions. For public lamps, 1929, 10,790 million c.ft.; 1930, 11,288 millions. The falling off is under the head of ordinary and power consumers, who accounted for 175,468 million c.ft. in 1929, and only 170,737 millions last year. Thus it is perfectly safe to assume that depression in trade has been the only adverse factor in connection with the consumption of gas. The total number of therms sold by all undertakings during 1930 was 1,383,311,448.

Propaganda

THE reduction on the present occasion, small as it is, will certainly catch the eye of those associated with the electrical industry who keep close watch on gas affairs, and they will in all probability make the most of it. This is specially likely to be the case as the official returns rendered to the Electricity Commissioners are showing some increase in the units of electricity generated by authorized undertakers in Great Britain. Electricity, being so much younger, has, of course, a great deal more uncultivated ground to cover than can possibly be the case with gas. It should, perhaps, be mentioned that the figures for electricity now before us relate to the month of September, 1931, whereas those for gas refer to the complete year 1930. The electricians get a boost in the newspaper Press each month, in connection with the issue of the official returns at this interval. The Gas Industry, on the other hand, has to be content with an annual Return, and so is not kept in the public eye in the same way as is electricity.

This is just one of the little ways in which gas finds itself at a disadvantage in the matter of publicity. There must be a firm resolve that what gas loses through yearly returns rather than monthly ones shall be made good in other directions. It is not impossible for undertakings to find from time to time "newsy" items which should make at least as strong an appeal as the monthly "electricity generated" intimation. Nowadays practically everyone, for example, is an investor, either large or small, and a paragraph on the steadiness of gas stocks, referred to in the earlier article (which can easily be prepared with the aid of the Stock Table published weekly in the "JOURNAL") would be appreciated in any news sheet or magazine.

More Consumers

HOWEVER, having now dealt with the decrease during last year of something less than 1 p.ct. in the sales of gas, we can point to the matters in which the present Return reveals actual improvement. In the first place, the total number of consumers as usual shows an increase—the gain being from 9,137,581 in 1929, to 9,343,834. This is a growth of 206,253, or 2·3 p.ct. An increase under this head is always gratifying, inasmuch as it represents a broadening of the base upon which the Industry rests. Dividing-up the increase, it is found that in 1930 there were 189,891 more prepayment consumers, and 16,362 more ordinary consumers. Here, again, there is the satisfactory feature of a substantial gain in the steadiest of all classes of gas users—the prepayment consumers.

The prepayment consumers now largely outnumber the ordinary ones; the figures being: Prepayment, 5,354,547; and ordinary, 3,989,287. Ten years ago the difference was very much smaller. As a matter of fact, in 1920 the prepayment consumers exceeded the ordinary ones by only 612,962, whereas for 1930 it will be seen that the difference in favour of the prepayment consumers is no less than 1,365,260. The Gas Industry is playing its part as a great public utility by increasing its service in the homes of the people.

Other Figures

TURNING to the works statistics, the quantity of coal carbonized last year was less than in 1929 by 218,000 tons. In the manufacture of water gas 159,000 tons less of coke and 9,010,000 gallons less of oil were used; the quantity of water gas made having decreased by 6824 million c.ft., or 14·7 p.ct. The quantity of coke and breeze made was less than in 1929 by 120,000 tons; the tar made was less by 376,000 gallons; and 3243 tons less of sulphate of ammonia was produced. The actual figures for 1930 are: Coal carbonized, 17,669,000 tons; coke used for water gas, 790,000 tons; oil used in manufacture of water gas, 49,073,000 gallons; coal gas made, 255,336,236,000 c.ft.; water gas made, 39,525,450,000 c.ft.; total gas made (including a certain amount of "other gas" and coke oven gas), 313,046,000,000 c.ft.; gas sold to prepayment consumers, 107,964,634,000 c.ft.; to ordinary and power consumers, &c., 170,737,354,000 c.ft.; for public lamps, 11,288,866,000 c.ft.; total gas sold, 289,991,000,000 c.ft.; coke and breeze made, 11,913,000 tons; tar, 214,762,000 gallons; sulphate of ammonia, 125,443 tons. There were at the end of 1930 50,218 miles of gas mains, which figure compares with 48,546 miles twelve months earlier.

A significant feature of the Return is the table which shows that the quantity of gas bought from owners of coke ovens during 1930, and distributed by statutory gas undertakings was 13,201,351,000 c.ft., or 20·6 p.ct. more

than in 1929. It may be added that the number of authorized gas undertakings in Great Britain as shown in the present Return is 767.

Engineers and Managers

IT is obvious that in his Presidential Address to the North of England Gas Managers' Association Mr. J. R. Bradshaw speaks as an Engineer. He expresses the attitude of an Engineer. His answer to the query, Is not too great a proportion of our time spent in ancillary and auxiliary duties and management as distinct from engineering? is in the affirmative. We are, he suggests, always having conferences, instead of settling down to work. Now in our opinion there is a nice balance between conference and immediate work; to the "man on the job" conference is anathema, and to smile socially appears a waste of time. Yet, to the Engineer and Manager, as distinct from the Engineer, conference is essential; and, as regards social work, we have yet to discover any industry so immune as the Gas Industry. Mr. Bradshaw deplores the fact that the representation on the committees and managements of many of our national and district organizations falls on such relatively few shoulders. This is the fault of the individual; there is always a remedy to too much hard work—let someone else do it!

Looking at the matter broadly, the engineer and manager of a gas undertaking has not too bad a time. Being an engineer, he is fully capable of checking the detail work of his assistants, and of guiding their work; being a manager, he is fully capable of getting the best out of his subordinates—and by "the best" we mean the best for them as well as for himself. Moreover, being a man of authority in the Gas Industry, he is able to voice his opinions publicly at conferences, so that these conferences will never degenerate into mere happy gatherings, but will yield what they were intended to yield—enlightened co-operative policy, and an understanding of the general, as distinct from the specialized, outlook. These separate conferences ought to be regarded as vehicles for preventing overlapping; and as far as the Gas Industry is concerned we think that there is very little overlapping among the various bodies. No one can possibly confuse the Institution of Gas Engineers and the British Commercial Gas Association, for example; and the National Gas Council has a distinct sphere of action—so has the Society of British Gas Industries. Mr. Bradshaw wants to see the formation of a committee to advise on the definition and limitation of the scope of each organization. The work of such a committee might, we suggest, tend to destroy a highly useful unity which our Industry has, in effect, at the present time. It might segregate rather than co-ordinate; and what we need more than anything in the Gas Industry to-day is co-operation.

Let us look for a moment at the organizations abroad, with especial reference to America. There all the various bodies are co-ordinated into one central unit, the A.G.A. But when we look at this admirable organization we find that it is sub-divided into many more groups than is our Industry at home, and that each of these separate entities is practically a law unto itself. This is inevitable. Where America scores is that the A.G.A. is a mouthpiece for all the groups. It is a question of "A.G.A. speaking!" In Great Britain, there is a definite understanding that each group is responsible for a particular line of investigation, and that the experts of any group are well capable of interpreting the Industry's opinion on particular questions. Mr. Bradshaw's idea of a committee of limitation does not therefore appear to us as necessary. A committee of unification, on the other hand, is quite a different matter. As Mr. Bradshaw says, "Co-ordination is necessary to a greater extent than obtains to-day." The whole thing appears to us more a matter of effective appeal than intrinsic strength of the various organizations of our Industry.

CORRESPONDENCE

Michael Faraday and the Gas Industry

SIR,—In connection with Sir David Milne-Watson's reference before the British Association to Michael Faraday's close connection with the Gas Industry, I think that the following additional facts are of interest.

As early in his scientific career as 1818, Michael Faraday's interest in the manufacture of gas is evidenced by a letter written by him to Prof. G. de la Rive, in which he says:

> That my letter may not, however, be entirely devoid of interest, I will take the liberty of mentioning and commending to you a new process for the preparation of gas for illumination.

A practical application of his work on the compression and liquefaction of gases is proposed in a contribution to the "Quarterly Journal of Science" (1823, 16, 239), in which he states:

> There is no reason for believing that oil gas or olifient gas has as yet been condensed into a liquid, or that it will take that form at common temperatures under a pressure of five, or ten, or even twenty atmospheres. If it were possible, a small, safe, and portable gas-lamp would immediately offer itself to us, which might be filled with liquid without being subject to any greater force than the strength of its vapour and would afford an abundant supply of gas as long as any of the liquid remained.

He did, in fact, construct such a lamp which contained cyanogen under four atmospheres pressure. He says: "It succeeded perfectly; but, of course, either the expense of the gas, the faint light of its flame, or its poisonous qualities would preclude its application. But we may, perhaps without being considered extravagant, be allowed to search in the products of oil, resins, coal, &c., distilled or otherwise treated, with this object in view. . . . ." That the suggestion was not an extravagant one is evidenced to-day by the large and increasing sale in the United States of "bottled gas" for domestic and industrial consumption.

Faraday carried out research on oil gas at the Royal Institution and studied, among other things, decomposition products formed in the gas during the process of manufacture (Phil. Trans. 1825, 440). His study of the physical effects occasioned by the release of the oil gas at the Portable Gas-Works, from cylinders under 30 atmospheres pressure, is described in the "Quarterly Journal of Science" (Vol. 23, 474).

With reference to Robert Faraday's lighting of the Athenæum with gas in 1836, it is of interest to note that he was helped in obtaining the contract by Michael Faraday, who had been the first Secretary to the Athenæum. His letter to the Secretary of the Club at that time contained the following:

> Few things would please me more than to help my brother in his business, or than to know that he had got the Athenæum work. . . .

Robert Faraday fitted "Sun burners," and a print showing one of these burners hangs in the Club.

Reference has been made by Sir David Milne-Watson to Michael Faraday's work on the ventilation of gas burners and to his gift to his brother of his invention on this subject. The original letter as referred to in "The Times" of Oct. 2, in which Michael fully describes the invention and offers it to Robert, is still extant and is in the possession of Mr. Paul Faraday. In this letter, and also in his lecture to the Institution of Civil Engineers on a "Description of a Mode of obtaining the Perfect Ventilation of Lamp-Burners," it is seen that he originally placed his ventilating shaft inside the lamp burner, but appearance and other considerations caused him to modify the arrangement to the type described in the patent. A reprint of the above lecture contains the statement that "Mr. Prof. Faraday has transferred his right to this invention to his brother Mr. Robert Faraday, 114, Wardour Street, Soho, who has secured it by a patent."

This ventilating device was very successful and became so widely adopted that it was fitted in all the bigger houses, clubs, and public buildings by the middle of the last century. Old prints of the Athenæum show Faraday's special ventilating shafts, three in number, projecting from the roof. They were removed when a third story was added to the building. In addition to the Athenæum, a number of other important buildings employed Robert

Faraday to install the new gas pipes and to supply fittings and hanging gasaliers. Among his commissions may be mentioned the following:

1837 The Egyptian Hall (Mansion House).
1838 Buckingham Palace.
1839 The Lord Chamberlain.
The Duke of Devonshire.
1841 C. Barry, Esq.
1842 The Portland Club.
1843 Reading Gaol.
1843 Windsor Castle.
1844 The Conservative Club.
The Earl of Ripon.
1845 Baron Rothschild.
1846 The Coventry Club.
The House of Lords.
1847 The Temple.
The Carlton Club.
The Freemasons' Hall.
1848 The Electric Telegraph Company.
The Travellers' Club.

An old trade catalogue of Faraday & Son, as the firm became, is, I believe, in the South Kensington Museum.

In 1859 he was appointed to a Privy Council Commission to report on the lighting of public galleries by gas. The following are extracts from the report:

> There is nothing innate in coal gas which renders its application to the illumination of picture galleries objectionable. Its light, though not so white as that of the sun, is equally harmless; its radiant heat may be rendered innocuous by placing a sufficient distance between the gas jets and the pictures, while the heat of combustion may be rendered eminently serviceable in promoting ventilation.

and also the statement that

> The Commission think it right to state that they were unanimous on all the points to which their attention had been called, or which are referred to in this Report.

The "Gas Furnaces" lecture given at the Royal Institution on June 20, 1862, was a description of the method of operation and the principles underlying the gas producer and an account of its industrial application. Reference was made to its successful use in connection with the potter's kiln, the enamelling furnace, the metal melting furnace, the iron puddling furnace, and the glass furnace.

Michael Faraday and Accum, the eminent chemist and pioneer of gas lighting, were both assistants to Davy at the Royal Institution, and it is interesting to note that they both appeared as expert witnesses in an action brought by Severn King & Co., sugar refiners, against the Imperial Insurance Company. In this famous trial, which was noteworthy for the array of celebrated chemical talent employed, Faraday and others appeared for the Insurance Company, while Accum was among those on the side of the refiners.

W. A. Voss.

Oct. 5, 1931.

PERSONAL

We are pleased to be able to state that Mr. J. F. Ronca is making very satisfactory progress towards recovery from the operation which he underwent last week.

Mr. Reginald G. Clarry, who has interests with the Gas Industry and is Chairman of the British Road Tar Association, is again (for the sixth time) contesting Newport (Mon.) as a Conservative. It will be remembered that Mr. Clarry represented Newport from 1922, and was successful at a bye-election and three subsequent general elections, losing the seat in May, 1929. The Gas Industry will gain, as it did before, by Mr. Clarry's presence in the House of Commons, and we wish him success in his campaign.

The Stalybridge Corporation Gas Committee have appointed Mr. H. D. Carter, of the Preston Gas Company, as Commercial and Development Superintendent.

At Blackburn Town Council, on Oct. 8, the members approved of the appointment of Mr. E. Field as Engineering Assistant at the Greenbank Gas-Works.

The Newtownards Urban Council have unanimously appointed Mr. J. P. MacIlwaine, Town Clerk, with supervision over the Gas Department. Mr. MacIlwaine has been Gas Manager for several years. His grandfather was the first Clerk appointed by the old Town Commissioners of Newtownards.

Mr. Arthur Robson, Chief Constructional Engineer of the Furness Shipbuilding Company, Ltd., of Haverton Hill-on-Tees, has been appointed General Manager of the Chepstow (Monmouth) constructional works of the Fairfield Shipbuilding and Engineering Company, Ltd.

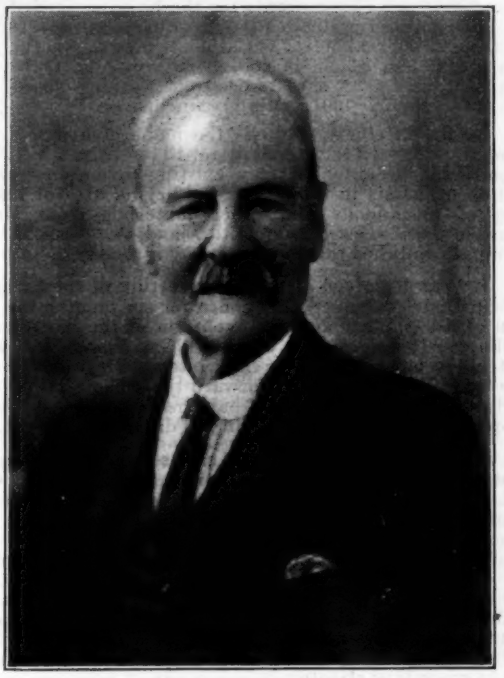
Mr. T. A. Hawkins, a Cannock Chase coalowner, and Mrs. Hawkins last week celebrated their golden wedding. Mr. Hawkins is Chairman of the Cannock and Hednesford Gas Company, of which he has been a Director for 45 years.

Mr. D. Dewar Melvin, Engineer and Manager, Uddingston Gas-Works, was married, on Sept. 30, to Miss Molly McKee, of Rutherglen. They were the recipients of handsome gifts, including many from members of the gas profession and one from the staff and workmen at Uddingston Works.

OBITUARY

MR. GEORGE GOATLEY.

The death of Mr. George Goatley, as was announced in the "Journal" last week, took place on Sept. 23. De-



ceased was in his 89th year, and up to May last was (by his own choice) "on active service" with the Davis Gas Stove Company, Ltd.

The death is announced of Mr. Harry Cecil Hess, aged 50, of Chipping Norton, formerly Manager of the local Gas Undertaking.

THE NEWS OF THE WEEK

An Increase in Dividend was passed at the half-yearly meeting of the Bendigo Gas Company (Australia)—3s. 6d. a share instead of 3s.

The Shipley Gas Committee have approved a suggestion of the Engineer that a pendant and gas switch be supplied on hire-purchase system in four instalments, one at 7s. 6d. down and three half-yearly payments of 5s.

The Southport Gas Committee have decided to invite tenders for the conversion of premises in Eastbank Street, into a gas showroom, with a demonstration room and store room behind, and accommodation for two caretakers, in accordance with the Gas Engineer's plans and specification.

The Port Talbot Corporation have placed an order with Messrs. C. & W. Walker, Ltd., of Midland Iron Works, Donnington, near Wellington, Shropshire, for extensions to their gas-works, consisting of water condenser, Pelouze & Audouin tar extractor, Livesey washer, and rotary washer scrubber.

A Correction.—A slip occurred in our editorial columns in the "JOURNAL" last week. On p. 50 it was stated that the sales of gas in Exeter had grown from 264 millions to 534 millions in the last twenty years. This increase represents the ordinary consumers' total. The figures should read from 321 millions in 1910 to 749 millions in 1930.

The Imperial Continental Gas Association have resolved that out of the profits for the half-year ended Sept. 30, 1931, an interim dividend at the rate of 7½ p.ct. (actual) on the £2,800,000 capital stock of the Association be paid, less income-tax at 5s. in the £, on Nov. 13, 1931. The Transfer Books of the Association will be closed from Oct. 26 to Nov. 7, 1931, both days inclusive.

Nesfield Retorts, Ltd., is the name of a new private company recently registered at 15, Eldon Street, E.C. 2, to acquire the benefit of certain existing inventions relating to improvements in retorts for the drying and/or distillation of bituminous and other materials from Messrs. Sensible Heat Distillation, Ltd., and A. Nesfield. The nominal capital of this new company is £1000.

It Was Resolved at a recent meeting of the Sidmouth Urban District Council to adjourn for six months the erection of a gasholder and the extension of the gas mains to Sidbury. It was stated that the Gas Committee would watch developments during the winter and consider whether it would be possible to put forward the scheme again in the early spring. A resolution that the preparations for the proposed gas showrooms be deferred did not find a seconder.

Improved Public Lighting at Droitwich.—During the past two years, under the Superintendence of Mr. C. C. Sidaway, Engineer and Manager of the Gas Department at Droitwich, the standard of the public lighting has been generally increased, especially in the main streets, with marked improvement for motor traffic. In place of the old one-light and two-light lanterns, **U** lamps with three-light No. 2 mantles in alignment or cluster, or lanterns with four-light bijou mantles in alignment with Holophane refractors have been adopted in the main streets, and three-light bijou in alignment lanterns with Holophane refractors in the secondary streets.

"Come In and Ask Questions," is the open invitation of the Stalybridge Corporation Gas Committee to the townspeople. Councillor J. W. Greenwood, J.P., as Chairman, speaking at the opening of an exhibition of appliances, said: "People ought not to require any invitation to come here, because they are only coming to see their own property. You are coming into your own showroom, and you have just as perfect a right of entry as I have, and to ask any questions of anyone in charge about any appliances we have in the place." It was stated that Mr. Carter, the newly-appointed Gas Department Superintendent, intended to organize an army of canvassers to wait upon householders to demonstrate to them the advantages of the use of gas.

Considerable Interest is being roused in Neath and district in the possibilities of the new gas switch for lighting. The Manager, Mr. W. Clark Jackson, has had one of these switches fitted in the wood frame of the window of each of the gas showrooms, with a notice inviting the passers-by to switch on the lights in the showrooms. The switch is incessantly in play and the rooms flooded with light. It is a practical demonstration of the reliability of the switch.

The Revenue Account of the Cirencester Gas Company, Ltd., shows a profit on the year's working of £3320. Interest on the debentures and the interim dividend at the statutory rate have been paid, and the Directors recommend a final dividend at the rate of £14, £7, and £9 16s. p.ct. on the several classes of shares respectively, making £12, £6, and £8 8s. p.ct. for the year. The sale of gas continues to show a satisfactory advance, the increased consumption over last year being 3½ million c.ft.

Consequent Upon the Amalgamation of the Hemel Hempsted District Gas Company a further 53 employees have joined the co-partnership fund of the Watford and St. Albans Gas Company, bringing the total membership to 382. The bonus and interest paid by the Company for the year amounts to the substantial sum of £2081. The membership of the pension fund has now reached 333, and the balance to the credit of the fund totals £13,184. The Directors have re-elected Mr. W. S. Coles to represent them on the Committee, and Messrs. Ferguson-Davie, Harris, & Co. to act as Auditors. The co-partners' representative, Mr. W. C. Cherry, and their Auditor, Mr. T. C. Wall, retire, but are eligible for re-election. Mr. H. C. Dunbar (Hempsted Works Manager) joins the Committee in accordance with the fund rules.

Forthcoming Engagements.

[*Secretaries of Gas and Kindred Organizations are asked to assist in making this diary of events as complete and useful as possible by sending the earliest intimation of all meetings.*]

Oct. 15.—SOCIETY OF BRITISH GAS INDUSTRIES.—Council Meeting in the afternoon.
Oct. 17.—MANCHESTER AND DISTRICT JUNIOR ASSOCIATION.—Annual General Meeting.
Oct. 20.—SOUTHERN ASSOCIATION (EASTERN DISTRICT).—Meeting at 28, Grosvenor Gardens, S.W. 1, at 2.30 p.m.
Oct. 20.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS (EASTERN DISTRICT).—Meeting.
Oct. 21.—INSTITUTE OF FUEL.—Annual Dinner and Dance at the Connaught Rooms.
Oct. 23.—LONDON AND SOUTHERN DISTRICT JUNIOR ASSOCIATION.—Opening Meeting and Presidential Address of Mr. J. H. Goldsmith.
Oct. 24.—MIDLAND JUNIOR ASSOCIATION.—Visit to Dudley Gas-Works.
Oct. 24.—SCOTTISH WESTERN JUNIORS.—Visit to Dalmarnock Power Station of the Glasgow Corporation Electricity Department.
Oct. 24.—YORKSHIRE JUNIOR ASSOCIATION.—Annual General Meeting.
Oct. 24.—WALES AND MONMOUTHSHIRE JUNIOR ASSOCIATION.—Visit to Water Pumping Station, Blaenclydach. Presidential Address by Mr. S. E. Brett.
Nov. 5.—MIDLAND ASSOCIATION.—Autumn Meeting in Birmingham.
Nov. 19.—B.C.G.A.—South Wales District Conference at Swansea.
Nov. 19.—SOCIETY OF BRITISH GAS INDUSTRIES.—Autumn General Meeting, Hotel Metropole.
Nov. 24.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS (EASTERN DISTRICT).—Meeting.
Nov. 25.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—General Meeting, Hotel Metropole, W.C., 2.30 p.m.

THE NEWS—*continued.*

Earl Haig British Legion Appeal.

On Remembrance Day, Nov. 11, will be made the 11th Annual Earl Haig's British Legion Appeal for Ex-Service men and their dependants. This Appeal provides the necessary funds to maintain the great organization which the British Legion has built up to assist those who fought in the Great War, together with their families, who are in distress.

This assistance is administered by 3388 voluntary committees which work throughout the year. The Fund has been taxed to the fullest extent of its resources, and this year times are certainly no better. The prevailing depression in trade and industry has caused the most serious distress among the men who cheerfully sacrificed health and security in our Country's service, and it is incumbent upon all of us, who are not unmindful of the debt of honour, to see to it that the unhappy lot of these men and their dependants is alleviated so far as human effort will allow.

To give, and give generously, for our Poppy on Remembrance Day should be our aim, at the same time rendering any personal service possible to the organization.

Throughout the Country on the Sunday preceding Armistice Day (Remembrance Sunday) collections are made in Churches of all denominations and given to the Appeal. If this were done in every Church, the Fund would be increased in such a measure as to enable assistance to be rendered to a far greater number who served and who—with their families—now suffer.

Many have already volunteered their services as helpers, but further assistance will be welcomed in all districts, and any who can spare time to assist with the sale of Poppies should write at once to the Local Organizer, or direct to The Organizing Secretary, British Legion Appeal Department, 18, South Street, Park Lane, London, W. 1.

Sheffield and Lincolnshire District Tar Board.

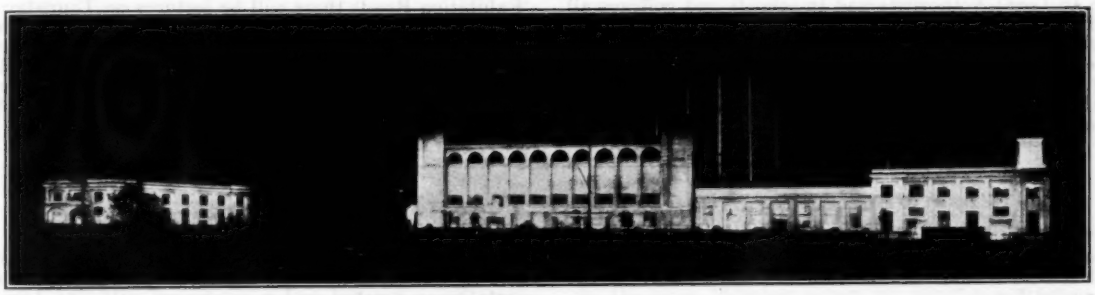
Presiding at the Annual Meeting of the Board on Sept. 29, Mr. Ralph Halkett (Chairman) said that a perusal of the report of the British Road Tar Association for the year ended June 30 last would show that the activities of the Association had continued on increasing lines, and that the Association had maintained its friendly relations with the various Government Departments and Associations which were so essential to successful negotiations.

"I need hardly remind you," continued Mr. Halkett, "that it is only by close co-operation of producers and distillers that the continued progress of the British Road Tar Association will be assured. Although we may congratulate ourselves on the increased membership, I would like to renew the appeal which was made by the Chairman at the last annual meeting of the District Tar Board for members to do all in their power to secure further members, especially from among the coke oven owners.

"With regard to experimental and research work, test lengths of road on the Kingston By-Pass have been laid with tarmacadam under the auspices of the Ministry of Transport, and the result of the experiment is awaited with confidence. The Ministry have also decided to carry out investigations into the question of surface dressings, and arrangements have already been made for the Association to co-operate in surface dressing two lengths with tar. Negotiations have been proceeding between the Managing Council and the Ministry of Agriculture and Fisheries with regard to the toxic effect of tar on fish life. These negotiations are now nearing completion, and a demonstration is shortly to take place by dressing a selected road adjoining the Ministry's Experimental Station at Alresford. A 500-yard length of the main Carlisle-Glasgow Road was, at the invitation of the Cumberland County Surveyor, dressed with tar last September, with entirely satisfactory results. The Managing Council are also co-operating with the Kensington Surveyor and the West Riding Surveyor in experiments of surface dressing of rock asphalt and tarmacadam respectively, and it is hoped that joint experiments with prominent surveyors will become more and more a feature of the Association's work."

Mr. Halkett concluded by saying that the work carried out by the Association is undoubtedly of immense value to the tar industry, and fully warrants all the support that can be accorded to the Association.

FLOODLIGHTING OF BOURNEMOUTH'S GAS-WORKS.



The above photograph shows the floodlighting at the Pitwines Works of the Bournemouth Gas and Water Company. This lighting was carried out by means of thirteen 1000 candle-power low-pressure superheater Sugg's burners, each consisting of 16 mantles, to illuminate the main block of buildings, and four similar units to the above for the sulphate plant shown on the left of the photograph.

Motorists Need Better Street Lighting.

A plea for more consideration for motorists in the lighting of roads in view of the ever-increasing growth of fast traffic in London's suburbs was made by Dr. G. S. Thomas, Vice-President of the Physical Society, speaking at the Camberwell Rotary Club on Wednesday, Oct. 7.

"Street illumination to-day is an exact science," said Dr. Thomas. "The illumination of a street can be measured with almost the same precision as one can measure a yard of cloth. Present day methods of measuring the light on a road's surface are not, however, as effective as they might be. In the majority of cases a test point is taken on the roadway instead of estimating the light shed over the entire surface. Motorists and pedestrians are not concerned with illumination at one point but over the whole of a road's surface."

"Recognizing this," added Dr. Thomas, "the South Metropolitan Gas Company, which is largely responsible for the re-organization of street lighting in South London, has adopted a special system of illumination measurement of its own. The roads have also been divided into four classifications—bus and tram routes; bus or tram routes; routes for fast moving traffic; and side streets."

Nottingham Gas Manager's Salary.

A Lively Debate.

The proposal to pay a commencing salary of £1750 per annum to the new Engineer and General Manager of the Nottingham Gas Department (Mr. G. Dixon) gave rise to conflicting opinions at the last meeting of the Nottingham City Council, though the report recommending the appointment of Mr. Dixon was eventually carried without a dissentient.

Mr. J. Cobley contended that the salary proposed was "an outrageous figure;" but Alderman H. Bowles, leader of the Labour Party, said that a man who had to manage

THE NEWS—*continued.*

one of the largest undertakings in the country, and who had to face the growth of electricity, had to be more alert than in the past, when he had practically a monopoly. He submitted that £1750 for a man who was capable of managing Nottingham's Gas-Works was not an exorbitant sum. Mr. J. Lynch declared that the greatest superman in the world was not worth £34 a week. Such an idea might be distasteful, but the masses of people were not in the frame of mind to see their rates foolishly wasted. Alderman Sir Albert Ball, Chairman of the Gas Committee, observed that £1750 was not a big salary for such responsibility. "You cannot pay a man too much if he can earn it," he said.

Tar Talks.

There was shown for the first time, in the Whitehall Rooms of the Hotel Metropole last Wednesday, by the British Road Tar Association, a well-planned and admirably executed film entitled "Coal Mine to Road," which has been made at coal mines, coke ovens, gas-works, tar distilleries, and on the highways and streets all over the country. The film is of just the right length to hold interest to the end, and the tinted gas-works pictures are particularly effective. Those who had been invited to see the film (which was preceded by luncheon) were received by the President (Sir David Milne-Watson) and the Chairman (Mr. Reginald G. Clarry).

In these days, when £60,000,000 is being spent every year on road work, and when there is urgent need for national economy, it is important from the point of view of the motorist and the ratepayer that everyone should know how the materials for road work are produced. This film has been made to demonstrate to the Authorities who are responsible for construction and maintenance of roads the advantages of using all-British materials. It will be shown to Local Authorities and in schools and colleges all over Britain, while a shorter version called "Tar" will be exhibited in several hundred cinema theatres. The people who contribute the £60,000,000 and the people who spend it, therefore, will get from the film some idea of the way their money should be spent. It is the biggest effort yet made to show the public that the natural resources of the country are ample to meet all requirements for roads. Every penny that is spent on tar goes to workers and producers in this country. Hence this is patriotic propaganda, upon which all concerned are to be congratulated.

Illuminating Engineering Society.

The Opening Meeting of the Illuminating Engineering Society is to be held at the E.L.M.A. Lighting Service Bureau, 15, Savoy Street, Strand, W.C. 2, on Tuesday, Oct. 20, 1931, at 6.30 p.m., when the Report on Progress will be presented, and there will be a series of exhibits illustrating progress in illuminating engineering. Any members desirous of showing novel instruments, apparatus or lighting equipment are requested to inform the Hon. Secretary (Mr. J. S. Dow, 32, Victoria Street, S.W. 1) as soon as possible.

At the subsequent meeting of the Society to be held at the House of the Royal Society of Arts, John Street, Adelphi, W.C. 2, at 6.30 p.m. on Friday, Oct. 30, 1931, a discussion on Floodlighting in connection with the International Illumination Congress will be opened by Mr. Percy Good.

Research in the British Glass Industry.

Sir Richard Gregory, Bart., LL.D., D.Sc., F.R.A.S., will open at 4 p.m. on Wednesday, Oct. 21, at the Science Museum, South Kensington, an exhibition which will illustrate modern research in the British glass industry. This exhibition is being arranged by the Society of Glass Technology, with the support of the Glass Research Delegacy. The Society of Glass Technology was the first of its kind in the world.

In addition to the exhibition (which will be set out in a small gallery at the right-hand side of the entrance in Exhibition Road) there will be lectures on Thursday afternoons by well-known authorities, dealing with the modern developments in optical glass, plate glass, electric light bulbs, safety glass, and artistic glassware. The public will also have an opportunity of seeing glassmaking in cinema films. These films will be shown every day at 4.15 p.m. until the exhibition closes on Dec. 31, 1931.

Further Potential Gas Investments

A further number of gas companies are dealt with in the "Potential Investments" column of recent issues of the "Financial Times."

South Metropolitan Gas Company.

This Company, founded in 1829, has been operating for over a century. It was incorporated in 1842 by Special Act, and to-day the area of service covers about 52 square miles, comprising nearly all of the County of London south of the Thames and parts of the counties of Surrey and Kent. The Company has a substantial interest in, and furnishes gas in bulk to, the South Suburban Gas Company, which supplies an area of 185 square miles. In October last a working arrangement by means of a share exchange agreement was effected with the Commercial Gas Company, which is bound to prove of mutual benefit in many directions.

Below are set out the quantities of gas and residuals sold during the past four years:

Year to Dec. 31.	Gas.	Coke.	Breeze.	Tar.
	1000 Therms.	Tons.	Tons.	Gallons.
1927	89,928	619,091	88,540	7,150
1928	89,792	590,664	89,035	6,945
1929	94,559	638,354	86,882	5,333
1930	93,120	554,229	96,194	4,865

In respect of the same period the financial results were as under, net revenue being struck after providing for debenture and other interest and income-tax, and after charging amounts transferred to co-partnership fund:

Year to Dec. 31.	Net Revenue.	Ordinary Dividend.	To Special Purposes Fund.	Co-Partnership Fund.
	£	Per Cent.	£	£
1927	414,350	6¼	..	82,624
1928	442,171		..	82,624
1929	479,313		30,000	83,874
1930	534,103		40,000	83,874

The satisfactory figures of last year were mainly due to a saving of nearly £100,000 in manufacturing costs, and further economies may be reasonably expected from the installation erected under agreement with the Low Temperature Carbonization Company.

On account of the current year the usual interim dividend of 2½ p.ct. on the Ordinary stock was paid on Sept. 2.

South Suburban Gas Company.

The South Suburban Gas Company was originally the Crystal Palace District Gas Company established in 1854, was incorporated by Special Act in 1858, and the present name was adopted in 1904. With the rapid development of contiguous districts, outlying kindred undertakings have been absorbed from time to time—namely, the Bromley and Crays and the West Kent Gas Companies in 1912, the Dartford Company in 1919, and the Northfleet and Greenhithe in 1929.

The area supplied now comprises 185 square miles, and includes parts of the Metropolitan Boroughs of Lewisham, Camberwell and Lambeth and the County Borough of Croydon, the whole of Beckenham, Penge, Bromley, Orpington, Chislehurst, the Crays, Sidcup, Bexley, &c., and the important industrial districts of Crayford, Dartford, Erith, Northfleet, and Greenhithe.

The Company now ranks third among the Metropolitan and suburban gas undertakings. In 1927 an agreement was entered into with the South Metropolitan Gas Company, which provides for the sale to the Company of gas in bulk (with other working arrangements) by the South Metropolitan for a period of 25 years or longer, subject to two years' notice.

Under the Company's Act of 1928 the basic price of gas was fixed at 11d. per therm as from Jan. 1, 1929, and the basic rate of Ordinary dividend at 5 p.ct., and the latter may rise according as the selling price is below the basic price. Distributions have been as follows: 1921, 5½ p.ct.; 1922, 6 p.ct.; 1923, 6¼ p.ct.; and 6½ p.ct. each year since.

East Surrey Gas Company.

The East Surrey Gas Company, it is stated, was established in 1860 and incorporated by the special Act of 1865

as the Redhill Gas Company. In 1921 the Reigate Gas Company was acquired, in 1924 the Godstone District Gas Company, and in 1928 the Dorking Gas Company. The area of supply comprises some 120 square miles of the North Downs, in which are situated those numerous townships, villages, &c., in which the population is rapidly growing with the enterprising development of the Southern Railway system.

In common with kindred public utility undertakings the standard Ordinary stock dividend is based on a sliding scale. The fixed standard price is 16·8d. per therm, and the price at the close of last year was 12·4d. per therm.

The authorized capital stock is £494,220, of which there is issued and paid up £359,700, including the premium of £887 on the Ordinary "B" stock, less £606 discount.

Bournemouth Gas and Water Company.

The Bournemouth Gas and Water Company, states the "Financial Times," was registered in 1863 and incorporated by the Special Act of 1873, and further powers have been subsequently conferred. The statutory area of supply now comprises 206 square miles—namely, gas 144 square miles, including the boroughs of Bournemouth, Poole, and Christchurch; water 62 square miles, including all Bournemouth, except Southbourne.

Under an experienced financial and technical Board the administration of the Company has been conducted on the soundest lines, and its record is one of continued progress with the steadily increasing requirements of a district which has shown extraordinary development. During the past forty years sales of gas have increased fifteen times and water revenue six times, while the subscribed capital has only been multiplied by seven. This is an exceptionally fine achievement, especially as both water and gas charges have been frequently reduced.

The Cheltenham Company.

The Cheltenham Gas Light and Coke Company is another of the more than century-old provincial undertakings which have proved their worth both from the public utility and investment standpoints. The Company was incorporated by Special Act in 1819, and for many years it has maintained a steady 5 p.ct. dividend on its Ordinary stock.

In June, 1930, the Company applied for a Special Order to authorize (*inter alia*) a change of name, an extension of the area of supply and the acquisition of the undertakings of the Tewkesbury Gas Company and the Winchcomb Gas Light and Coke Company, the creation of Consolidated Ordinary stock for such purpose, and other matters incidental thereto as regards capital.

In their last report the Directors stated that, owing to the necessarily wide scope of the Order above referred to, and to the variety of the interests involved, it was not possible to get the Order passed during 1930, but it was confidently anticipated that its passage would not be long delayed.

Under the Gas Regulation Act of 1920, the maximum price of gas was fixed at 17·2d. per therm within the Borough of Cheltenham and 19·6d. in the outside area. At the close of last year the respective prices were 8·75d. and 10d. Dividends are not subject to a sliding scale.

IN CONTINENTAL COUNTRIES - - -

Abstract Translations from the Technical Press of France and Germany.

REMOVAL OF SCALE FROM WATER HEATERS.

F. Hinden, in "Monats Bulletin des Schweizer. Vereins von Gas- und Wasserfachmännern," 1931, XI., 259-260 (Aug.), describes an investigation of the action of acids on various metals employed in the construction of water heaters with a view to formulating proposals for suitable methods for removing scale derived from the water.

Hydrochloric acid is not a good agent to employ in view of the damage which it causes, especially to aluminium, zinc, and galvanized iron. Recently, dilute formic and acetic acids have been employed, since these dissolve the scale readily, though they attack the metals concerned but slightly.

The comparative attacks of the various acids were as follows in mgms./sq. dm. at 20° C.:

Metal.	Acid.	Time. (Hours.)	Acid Concentration.		
			8 P.Ct.	16 P.Ct.	24 P.Ct.
Zinc	Hydrochloric	2½	30,572	..	..
Zinc	Formic	24	3,665	3110	2250
Zinc	Acetic	24	72	25	..
Aluminium	Hydrochloric	2½	962	..	..
Aluminium	Formic	24	7	9	5
Tin	Hydrochloric	24	44	..	..
Tin	Formic	24	29	..	..
Copper	Hydrochloric	24	20	..	..
Copper	Formic	24	5	15	5
Brass	Hydrochloric	24	13	..	..
Brass	Formic	24	5	7	6

Heating apparatus may be cleaned by filling it with the appropriate dilute acid which is emptied out after a few hours, when either the scale has dissolved or the acid is spent. In the case of a thick scale, 2 or 3 further lots of acid may be needed. Under suitable conditions, the acid may be employed warm. Finally, a thorough rinsing with water is given.

The following recommendations are made:

Heaters made of copper or brass and not tinned (hard soldered)	8–10 p.ct. hydrochloric acid
Heaters made of aluminium or tinned metals	5–10 p.ct. formic acid
Heaters made of zinc or galvanized iron	15 p.ct. acetic acid

STATISTICS RELATIVE TO TAR IN FRANCE.

In the "Journal" of April 22, 1931 (p. 216), information covering the quantity of road tar used annually in France from 1922-1929 was given and reference was made to the large increase shown by 1929 in comparison with 1928.

Particulars covering 1930 are now available and are taken from an abstract in "Journal des Usines à Gaz," 1931, 55, 457-461 (Sept. 20), of the annual report of the Central Committee of French Tar Producers and Distillers.

The quantities of tar produced in 1929 and 1930 were as follows in metric tons:

	1929.		1930.	
	France.	Sarre.	France.	Sarre.
Gas-works	241,000	5,000	239,000	..
Coke-oven works, &c.	320,000	122,000	356,000	..
	561,000	127,000	595,000	140,000

In addition, in 1930, 94,000 tons were imported (of which Great Britain supplied 44,000) and 22,000 tons were exported. The total tar available for use was thus 807,000 tons, of which 330,000 tons were distilled to pitch and 451,000 tons (compared with 367,500 tons in 1929) were used for road purposes. The quantity of tar employed for road purposes thus continues to increase rapidly.

The distribution of the tar used on the roads in France was as follows, 1000 tons having been employed in the Sarre:

Used in crude form	168,000 tons
Converted into road tar	203,000 ,,
Used for tar macadam manufacture	40,000 ,,
Used by private contractors	35,000 ,,
Used for tar emulsion manufacture	4,000 ,,
	450,000 tons

THE "JOURNAL" TECHNICAL RECORD

Which contains Reports of Meetings of Gas and Allied Associations.

The British Fuel Problem

Discussions by the British Association for the Advancement of Science

By Sir DAVID MILNE-WATSON, D.L., LL.D., Governor of the Gas Light and Coke Company

One of the most important problems of the coal industry to-day is to make all varieties of coal, whether large or small, contribute their proper quota to the cost of production. That coal owners are alive to this question is evidenced by the considerable increase in cleaning plants installed in recent years. The capacity of these now amounts to 29·8 p.ct. of the total coal mined. In the past the greater portion of the demand has been for large coal, and the profitable prices have always been received for such grades. The buyer's preference has in the main rested on the lower ash content of these larger sizes, although for many purposes the coal has actually had to be crushed before use. Examples of this are seen in coal for steam raising, for coke making and for gas making. With the improvement of small coals by pre-treatment at the collieries the demand for them is increasing. This must eventually affect larger coal which will tend to fall in price.

The depression in the iron and steel trades has affected the demand for coal from 31·4 million tons before the war to 18·79 million tons last year. Some portion of this fall arises from improved efficiency, and when the industry is restored to prosperity a further saving under this heading may be expected. In this country coke ovens are mainly associated with collieries. Iron works are to be found near the deposits of ore and occasionally associated with steel works, but as a rule steel works are situated away from collieries, ovens, and blast furnaces. This lack of juxtaposition and co-operative working has made the British figure of coal used per ton of steel reach 2 to 3 tons, whereas in Germany and America, owing to the common centralization of all works on one site, effecting a ready interchange of energy in the form of coke, blast furnace gas, coal gas, and electricity, a figure of 1½ tons of coal is attained. In recent years the linking up of gas-works with coke ovens and steel works has been practised in America and Germany, and quite recently Parliament has approved the setting up of such a joint scheme between the coke ovens, steel works, and gas-works in the neighbourhood of Sheffield.

The National Electricity Scheme has received much publicity, and it was to be expected that the increased production of this form of energy would bring about an increase in coal consumption. This has taken place, but improvements in generating efficiency have counteracted the increasing consumption, and in the past year there was actually a small reduction in coal demand of 160,000 tons.

THERMODYNAMICAL LIMITATIONS.

So long as our method of obtaining power is dependent upon the use of steam, so long will it be of necessity inefficient, because of the thermodynamical limitations of this medium. With the very best means of firing boilers, with the highest steam pressures and temperatures, and with the most efficient electricity generating and transmitting plant, we are limited by natural laws to the delivery of about 20 p.ct. of the energy of the coal to the ultimate consumer. To-day, in spite of the magnificent efforts of the electrical industry, we have not reached an average figure of more than 12 p.ct. It can be conceded, therefore, that as a means of transmitting power in its various forms the National Electricity Scheme is of the utmost importance and value to the nation. Electricity itself is, however, inherently inefficient as a source of heat supply, and except for special processes, the efforts of electricity in this direction can be surpassed not only in economy and efficiency but to the national advantage by the carbonization of coal and the right use of the resulting products.

Carbonization of coal is almost entirely confined to two industries—the Gas Industry and the coking industry. Each industry treats some 18 million tons of coal per annum, or 36 million tons in all. Their methods are in principle identical and their products are of the same nature, but the relative proportions of gas and coke made for sale by the two industries differ as in each case the product which is not the primary one is used for heating the retorting vessels. The carbonization of coal as practised in gas-works returns over 80 p.ct. of the original thermal value of the coal to the public. The annual sales of gas by the Industry amount to over 300,000 million c.ft.; this is equal to 6740 c.ft., or 32·3 therms, per head of population. The total sales of coke by the Gas Industry supplemented by a proportion from the coking industry for domestic and industrial purposes amount to 9,800,000 tons annually, or 4½ cwt. per head of population.

No official figures for the use of coal, gas, &c. for domestic purposes only are available, but it would appear that an approximate estimate of the consumption of energy for domestic purposes other than lighting per head of population would be—

Coal	16 cwt.	equivalent to	22,400,000	B.Th.U.
Gas	4500 c.ft.	,, ,,	2,160,000	,,
Coke	2½ cwt.	,, ,,	3,400,000	,,
Electricity	10 units	,, ,,	34,120	,,

The relative employment of fuels for heating and cooking in the home is thus, in terms of potential heat: Coal, 80·0 p.ct.; coke, 12·2 p.ct.; gas, 7·7 p.ct.; and electricity, 0·1 p.ct. The very different efficiencies obtained in the use of these various fuels makes it necessary, however, in order to get a true picture, to take into consideration the amount of heat usefully received from them.

Assuming mean average efficiencies in use as follows:

	P.Ct.
Coal	12
Gas	60
Coke	30
Electricity	80

the amount of domestic heat usefully employed per head of population per annum becomes from—

	B.Th.U.
Coal	2,688,000
Gas	1,296,000
Coke	1,020,000
Electricity	27,300

a total of 5,031,300 B.Th.U.

On this basis the relative proportions of useful heat become from coal 53·4 p.ct., gas 25·8 p.ct., coke 20·3 p.ct., and electricity 0·5 p.ct. It will be noticed that the service received from the combustion of raw coal is rather more than the combined returns received from gas and coke. From this it follows that if the present consumption of gas and coke for domestic purposes were doubled, the use of raw coal could be almost abolished. This would entail the carbonization of some 14 million tons of coal in addition to the present quantity, giving an additional yield of 130 million gallons of tar oils, and tar derivatives. Most of the smoke in the atmosphere would be removed and the country would benefit from the increased production of oils at home.

LOW-TEMPERATURE CARBONIZATION.

No review of the field of the carbonization of coal could overlook the question of low-temperature carbonization. The Gas Industry is in no way antagonistic to the use of low-temperature and would adopt such processes if there were any prospect of an improvement in its own methods which would be commercially successful. In view of our dependence upon supplies of foreign oil, the additional yield of oil (up to 10 gallons per ton) secured by low-temperature

treatment, although still worthy of earnest consideration, has become of less importance now that another method of coal treatment—hydrogenation—has come into the field. This treatment can be applied either to the tar oils of any carbonization system or to certain definite classes of coal. The process can produce motor spirits from heavy oils, and recently successful work has been done both at Billingham Works of Imperial Chemical Industries and by the Fuel Research Board. Over 50 p.ct. of coal gas is hydrogen, so that in any carbonizing process the whole of the essential materials is at hand. During the summer gas-works are approximately on half load, so that a supply of hydrogen is available here at low cost. It has been estimated that a hydrogenation plant producing (say) 40 million gallons of oil from coal per annum would cost £7,000,000; would use 1,250,000 tons of coal yearly in all, and give employment permanently to 5000 men. In the carbonization of coal, therefore, we have processes which do at present provide cheap, smokeless, and efficient heat to home and industry, and which, by conjunction with known processes, could be extended to add their present contribution to our oil requirements.

Future Possibilities of Fuel Utilization

By H. T. Tizard, Rector, Imperial College of Science and Technology.

Considering new developments which might cause an increased demand for coal without denying our principle of "conservation of energy," the author mentioned low-temperature carbonization, electrification, and the hydrogenation of coal. The chief objects of low-temperature carbonization are to produce a solid smokeless fuel for domestic and industrial use, and a home supply of fuel oil. It has had every chance of demonstrating that it can do so successfully. Over ten years' concentrated work, however, which started with the benefit of a great deal of experience previously collected, has resulted in failure to produce anywhere in this country satisfactory evidence of a commercially successful plant.

The fact is that low-temperature carbonization of coal suffers from the fundamental disadvantage that the temperature is low. This has two main consequences. One is that the transfer of heat, and the reactions, are slow, and therefore that the size of plant to produce a given output tends to be greater than that necessary in high-temperature carbonization; the other, perhaps more important, consequence is that the yield of the product of most value, which is gas, is also correspondingly low. As a self-contained commercial enterprise on the large scale, low-temperature carbonization must be regarded as dead; it may yet find, in a modified form, a useful place in conjunction with existing gas undertakings, but it has ceased to be of outstanding national importance, and in the author's considered opinion its further development would much better be quietly left to the enterprise of gas engineers.

Are we then to give up our ideals of smokeless combustion? By no means. It is a great mistake to imagine that the use of low-temperature coke is the only or even the best method of combatting the smoke nuisance. To start with, the emission of smoke into the atmosphere is directly proportional to the amount of raw coal burnt. The conservation of coal naturally leads to a less smoky atmosphere. Further, it is quite possible, without undue cost, to stop all emission of smoke from large electricity stations—so that the generation of electricity on the large scale, besides encouraging economy in the use of coal for home production, makes it conceivable that the whole power requirements of the nation could be supplied without the emission of any smoke whatever. Finally, the domestic heating problem can be, and is being, most satisfactorily solved by the normal developments of the gas undertakings. As for the provision of a home supply of fuel oil, all one need say is that low-temperature tar is greatly inferior to natural fuel oil for the purposes of heating or power production, and that it cannot possibly be produced at a comparable cost. It almost certainly will have special uses in the chemical industry, but only on a relatively small scale.

The hydrogenation of coal presents a far more practical method of producing oil in quantity from coal at no higher cost. It is claimed that the yield of petrol from the process now may amount to as much as 60 p.ct. by weight of the coal treated, as the result of recent technical improvements. This statement has been received with some incredulity, but I see no reason at all to doubt its possibility. But, interesting as it is as a record of technical achievement, it is of little significance in assessing the commercial possibilities of the process, and it would be most unfortunate if the public were led to believe, by this and other recent statements in the Press, that commercial success is assured. We did not want a repetition of the financial history of low-temperature carbonization. No authoritative figures have been made available, but I should probably not be far wrong in assuming that 5 tons of coal are consumed in the manufacture of 1 ton of oil—that the over-all thermal efficiency of the process is not more than 25 p.ct. I conclude that it is possible, though not at present likely, to produce petrol by the hydrogenation of coal at a cost of 9d. per gallon. I should regard with scepticism any lower estimate.

If this is accepted as a fair basis, it leads to two conclusions. One is that we have in the hydrogenation of coal a process which is capable of producing motor fuel on a large scale of almost any desired magnitude at a price which experience has already shown is not prohibitive to the road transport industry. The second is that, in spite of this comforting thought, there is no present likelihood of being able to produce it in open competition with petrol from natural sources. The process could only be established on a large scale in this country under the protection of a tax which would virtually exclude for many years the competition of natural oil. My opinion is that this would be an economic mistake of the first order. The consideration in this connection is that the cost of producing heavy oil by hydrogenation is not likely to be much lower than the cost of producing petrol.

The development of compression ignition internal combustion engines, burning heavy oil, has been so successful that there are a number of motor omnibuses running in London so satisfactorily that it seems in the highest degree probable that in ten years' time, or so, most, if not all, heavy road transport will change over from the petrol engine to the heavy oil engine. Apart from the relative cheapness of the fuel, the over-all thermal efficiency of the compression ignition engine is in practice far greater than that of the petrol engine. The omnibuses referred to travel over 75 p.ct. greater distance per gallon than similar omnibuses fitted with petrol engines. The relative demand for light oils and heavy oils must eventually be considerably modified. Ultimately then, if not immediately, the competition of manufactured oil with natural oil must depend on the cost of production of heavy oil, not of petrol. The exclusion, by taxation, of imports of heavy oil into this country would have even more serious consequences than the exclusion of petrol from natural sources.

But of the importance of encouraging further experimental work there can be no doubt. At the least we can rightly regard the process as a valuable insurance for the future. We can confidently expect that, now that the chief technical difficulties have been overcome, the cost of producing oil by hydrogenation can be steadily reduced as a result of continuous experiment on a scale large enough for the vital questions of cost to be attacked. What the final result will be, no one could predict accurately on present information; the only prophecy I venture is that it is bound to be greater on a thermal basis than the minimum cost of producing electrical energy from coal.

In a reference to the bearing on the coal industry of electrical development, Mr. Tizard agreed with Sir David Milne-Watson's remarks on the disadvantages of electric heating for domestic purposes. Admittedly, he said, certain forms of electric heaters were convenient, but domestic heating on the large scale by means of electricity should certainly be discouraged in the national interest. It would be a gross, and quite unjustifiable, waste of national resources. The fact that electricity was sold at artificially low prices for domestic heating should not delude anyone into thinking that such prices could be maintained if the heating load ever became high. There was definitely no possibility that domestic heating on a large scale by electricity could be effected as cheaply as by gas.

British coal is pre-eminent for its high quality—but high quality is not essential for the production of electricity. There is only one obvious direction which might achieve

substantial results in fostering the export trade. We must take a fresh view of the Gas Industry, which offers yet great scope for the talent of chemists and engineers. Is it really impossible, for instance, to manufacture and distribute gas at the same cost, on a thermal basis, as refined heavy oil? It is in the cheapening of gas that I see the most hopeful means of checking the real competition of oil, and of giving a new impetus to the coal export trade. But the answer to this question depends not only on the encouragement of scientific research on all the problems of the Gas Industry, but on the removal of restrictions which hamper its industrial development.

The New Gas Industry

By Sir DAVID MILNE-WATSON, D.L., LL.D., Governor of the Gas Light and Coke Company

Sir David, commenting on the fact that the Centenary of Michael Faraday's discovery of magnetic induction had just been celebrated, said it is not generally known that Michael Faraday was closely connected with the Gas Industry. In addition to the interest which gas and illumination naturally excited in the mind of such a versatile scientist, the position which he held as scientific adviser to Trinity House tended to focus his attention on such subjects. There was, however, a very much stronger reason for Faraday's connection with the Gas Industry. His brother Robert, the brother who presented him with the shillings which enabled him to attend his first scientific lectures, was a gas engineer and vendor of gas appliances, with a shop and factory in Wardour Street, London, where the gas fittings and appliances were manufactured and sold. Michael Faraday had a direct connection with this business, and in his early days put his savings into it, so that at one time he had as much as £800 invested in it. Robert Faraday founded the business in 1815, three years after the establishment of the Gas Industry in London. A number of important houses, clubs, and public buildings employed him to install gas pipes and to supply fittings.

It is pleasing to recall, continued Sir David, that this small business grew and prospered, and is still in existence after 116 years, and is now controlled by a direct descendant of Robert Faraday. One of the commissions of the firm in its early days was the lighting of the Athenæum Club. The gas lighting as originally installed was not satisfactory, owing to poor ventilation, and Michael Faraday was called upon to give his advice. His work on lighthouse lamps enabled him to apply scientific principles of ventilation, which resulted in the lights working satisfactorily. This work he described in 1843, before the Royal Institution, and the Institution of Civil Engineers, while he made a present to his brother of the patent he had secured in respect of the perfect ventilation of gas burners.

Faraday's indirect connections with the Industry were probably of even more importance because, as the result of his work on a Privy Council Commission, and in other ways, the support of gas as a satisfactory illuminant by the leading scientists of the day undoubtedly had a reflection in public opinion, to the benefit of the Industry as a whole. A perusal of Michael Faraday's records of his researches shows that he carried out a considerable amount of work on the liquefaction and solidification of gases. As an outcome of his interest in gases and their behaviour under pressure he made his well-known discovery of benzene which he isolated from oil gas in 1825. In a lecture at the Royal Institution on Nov. 15, 1844, he reported unsuccessful attempts to liquefy coal gas. In 1851 he delivered a series of lectures at the Royal Institution entitled "Upon Some Points of Domestic and Chemical Philosophy" which were accompanied by experiments upon the production of gas from coal. In 1859 the Lords of the Committee of Privy Council on Education appointed Michael Faraday and other scientists to report on the lighting of picture galleries by gas. Their unanimous report is noteworthy for its favourable attitude towards the use of gas, which, after numerous practical tests, they found to be a perfectly satisfactory illuminant for the purpose. In 1862 Michael Faraday gave the last of his Friday evening Discourses at the Royal Institution, the subject being "Gas Furnaces."

Dealing in some detail with the Gas Industry, Sir David recounted a great deal of its early history, from the granting in 1812 of a Royal Charter to the Gas Light and Coke Company under an Act of Parliament passed in 1810. He also mentioned something of the work of Murdoch and Winsor, the growth of Parliamentary control, changes in the uses of gas, and the adoption of the therm.

The early difficulties of the Industry, legislative and otherwise, were then dealt with, all of which portrayed the difficulties of the pioneers and the advance of a chemical industry during a period when chemical science was itself in its infancy. Sir David showed that the legislation which still largely controls the Industry was devised to meet a state of affairs when its staple product was used for a purpose which forms a small proportion of its use to-day. Space prevented detailed reference to the engineering development of the Industry, or to the problems facing the designer called upon to provide gasholders of 20 million c.ft. capacity, carbonizing plants treating 1000 tons of coal per day, or gas plants pumping 100 million c.ft. of gas daily with velocities in the mains equal to that of an express train. Such examples, said Sir David, can be seen to-day in gas-works, many of them in London itself.

Coming to the year 1920, he recalled that the sale of gas was then established on the basis of its heating value, and said that gas undertakings are now doing a large business not only in their original purpose of lighting, but in the supply of heat and power. They were facing competition from electricity and oil, and competition in the disposal of their residual products of coke, tar, and ammonia, but were nevertheless the proud possessors of a record of difficulties surmounted, progress achieved, and of a reputation of over 110 years' service that has never failed. Yet, because of its age popular opinion inclined at times to the view that the Gas Industry is old-fashioned, out of date, and on the decline; in effect, that it is unscientific, and might be superseded without loss to the well-being of the nation. The action of successive Governments in agreeing to an expenditure which will exceed £50,000,000 in order to bring electricity supply undertakings up to date had encouraged the impression that gas will one day be superseded, and in fact that electricity is the one utility essential to the well-being of the State. Nothing was further from the truth than to say that the Gas Industry was a "back number." It might be interesting to say that to-day in Bond Street and Oxford Street more gas is used than ever, and yet the ordinary observer would say it was non-existent.

In disproving these existing fallacies, Sir David went on to show that out of the endeavours of the past there is in existence an Industry to-day of a highly scientific character, employing the best technical and commercial methods and fully equipped to continue to give useful and essential service to the nation. He did not assign a definite date to the birth of this new Gas Industry, but it had been growing steadily for years, and to-day it is on the up-grade. There are in all 1315 gas undertakings in the country at the present time. Of these 544 were non-statutory, supplying gas to rural districts by agreement with the respective local authorities. Each of the 771 statutory undertakings work under legislative authority in a defined area, and in 1929, which is the latest date for which official figures are available, the Industry treated 18,609,448 tons of coal, and for carburetted water gas used 949,235 tons of coke and 233,349 tons of oil. In the same period the products sold to the community were:

Gas—All undertakings	299,499,000,000 c.ft.
,, Statutory undertakings	292,598,000,000 ,,
Coke	8,015,437 tons
Tar and tar products	223,500,000 galls.
Sulphate of ammonia	161,743 tons

There are 9,640,853 consumers, giving an average consumption per annum per consumer of 30,547 c.ft., or 153 therms, and the annual consumption is 6740 c.ft., or 32·3 therms, per head of population. Of these consumers, 5½ million receive their supplies from the penny-in-the-slot meter. The present annual sales of gas by the Industry exceed 300,000 million c.ft. Converted into KW.-hour units of 3412 B.Th.U. the figure is equal to 44,000 million electrical units. The latest statistics regarding the sales of electricity show a total of 8,596,553,054 units. The energy sold to the public in the form of gas is thus over five times that sold in the form of electricity. On the assumption, from official data, that 70 p.ct. of the gas sold is for domestic purposes and that the similar figure for electricity is 20 p.ct. of the whole, the proportionate demands become

even more striking, the sales of gas energy to the houses of the people being 18 times those of electricity.

Last year the gas consumption of these islands increased by over 8000 million c.ft., an amount equal in heating energy value to 1173 million KW.-hours. The corresponding increase, in electricity, including power, traction, and similar fields almost untouched by gas, was 993 million KW.-hours, and this result was achieved during a period of intensive extension of electricity supply, supported by Government propaganda. The coal consumed for electricity generation is some 8,500,000 tons annually, and the public receive approximately 12 p.ct. of the potential energy. This figure compares with a return to the community of 26 p.ct. of the coal energy as gas, and over 80 p.ct. of the energy, when coke and tar products are included, from the coal treated by the Gas Industry.

The only other coal-treating industry which handles our national asset with an efficiency comparable to the Gas Industry is the metallurgical coke industry, which treats some 17 million tons of coal annually. An increasing proportion of the gas thus produced is used for towns' purposes, the remainder being employed for firing the ovens and industrial uses. The tar and ammonia products enter the same markets as those of the Gas Industry, while a proportion of the coke now competes with gas coke owing to the depression in the iron trades.

Sir David then dealt at length with the developments that have taken place in gas manufacture, outlining the features of horizontal and vertical retort working. The size of retort units in large installations has been increased from a daily throughput per retort of 2 tons per day of early installations to 10 tons at the present time, while the capacity of single individual plants has been raised to over 1000 tons per day. As a proof of the rapid adoption by the Industry of improved plant it may be noted that 60 p.ct. of the coal gas manufactured in gas-works in these islands to-day is produced in continuous vertical retorts—the majority of which are of post-war construction.

For certain classes of strongly coking coal, difficulties in the way of steady motion of the charge through the continuous retort have recently led to a revival of interest in the intermittent vertical retort in which the charge is static and is removed and replaced at intervals of 12-14 hours, the steaming process being confined to the last two hours of coking.

Although not generally applicable to gas-works, being unsuited to all except the largest, the modern coke oven used in metallurgical coke manufacture can also be adapted to economical gas-making. The Gas Light and Coke Company are at present installing at their Beckton Works a plant capable of carbonizing 1200 tons per day, and have arranged for its extension to 5000 tons per day. This plant, in accordance with the practice now coming into vogue in modern carbonizing plants, is provided with coal blending and mixing equipment designed to produce domestic and industrial coke of the highest quality. The coke so produced is screened, washed, and graded in special plants so as to yield a product vastly superior to the old time coke for the consumers' service.

The paper then reviewed many other matters of interest to the general public but all familiar to gas engineers, such as complete automatic working in carburetted water gas plant; the production of oils; improvements in gasholder construction; and many other details.

Underlying the whole scheme of operations whether chemical, physical, or mechanical the fundamental principles of gas manufacture have been absolute freedom from impurity and a constancy in regard to quality, which to-day only varies on an average of 0·2 to 0·4 p.ct., with a normal variation from the declared standard not exceeding 2 p.ct. in either direction, and, what is perhaps most important of all, assured continuity of supply at all times.

A great deal was also said of the improvements in gas appliances and the many services now rendered by gas.

Speaking of smokeless solid fuel, it was stated that while the Gas Industry provides an almost ideal service for any need requiring clean, controllable, and cheap heat there are still many situations where a smokeless solid fuel such as coke can render efficient service. For cheap supplies of hot water, for central heating, for foundry work, and many industrial uses, the demand for prepared coke continues to grow, some ten million tons annually being already used for these purposes. Quite recently coke in open grates has begun to be recognized as an excellent smokeless fuel now that grates specially designed for its use have found a place on the market. These grates are provided with a gas lighting device, control of rate of burning, and arrangements for removing the ash without spreading dust.

The Gas Industry of to-day, continues the paper, has realized the great importance of giving good service. Gone are the " take it or leave it " days of the past. The new Gas Industry employs highly trained staffs of salesmen, experts, and demonstrators, supported by organizations for research, well-equipped showrooms, and demonstration rooms. Organization for the maintenance and adjustment of consumers' appliances and for the replacement of out-of-date and inefficient apparatus has been introduced, and the latest office machinery is being installed for the making up of accounts. The gas service of to-day is full of vitality, enthusiasm, and keen scientific endeavour in every one of its manifold activities.

Enormous strides are being made in the application of the process of hydrogenation. Gas contains nearly 50 p.ct. of hydrogen, and here are vast potential sources of hydrogen, easily obtainable. This hydrogen reacting with the existing oils produced by high-temperature carbonization might well be the source of our own oil, although at present we have to rely on imported natural oils. In the provision of solid fuel for the open grate research had shown that a high volatile content is unnecessary to meet the conditions at present satisfied by raw coal. The reactivity, physical structure, and combustibility of coke fuels produced by high-temperature carbonization of coals prepared by cleaning, sizing, and blending before carbonization can be equal, if not superior, to either coal or low-temperature cokes.

The progress in recent years of the Industry, concluded the paper, shows a bright outlook whether in regard to its gaseous or solid products. Its activities are rich in scientific endeavour, and incorporate the very finest methods of affording service to its clients. Its experience both at home and abroad demonstrates its ability to meet its competitors on a fair field, be they electricity, oil, or coal. The Gas Industry to-day is virile, scientific, modern, and progressive.

Photographic Analysis of Explosion Flames

By Prof. W. A. BONE, F.R.S., Imperial College of Science and Technology

On Thursday, Sept. 24, in the Hall of the Royal Geographical Society, Prof. W. A. Bone, F.R.S., dealt in detail with the work that is being done at the Imperial College of Science in connection with the photographic analysis of explosion flames. In principle, the method usually employed for the photographic analysis of explosion flames is the same as that originally designed by Mallard and Le Chatelier fifty years ago. It consists of photographing the movements of the flame along a horizontal glass tube on a sensitized plate or film moving vertically at a suitable known velocity thus obtaining, *inter alia*, a graph compounded of the two velocities, from which that of the flame at any point can be deduced. The experimental method of Mallard and Le Chatelier was developed and improved by the late Prof. H. B. Dixon and his collaborators during the " nineties " of last century.

Within recent years the experimental method has been further developed and improved in the laboratories at the Imperial College, South Kensington, chiefly by means of the new high speed photographic machines designed by Mr. R. P. Fraser, which have so increased its analyzing power that it is now possible to photograph and measure movements in explosion flames occurring periodically with frequencies of up to 250,000 per second; and with a new type of camera, embodying the principle of a mirror revolving *in vacuo* at high constant velocity (up to 30,000 r.p.m.) and projecting the image of the explosion flame on to a stationary film it is hoped soon further to increase the analyzing power four or five fold; so that in the near future it should be possible to photograph and measure periodic flame movements occurring with frequencies of a million per second.

The results so far obtained have already modified and corrected many former ideas concerning the nature of the initial phase of slow uniform flame movement in gaseous explosion and, *inter alia*, disproving the supposed " law of flame speeds." Indeed, it now seems probable that what Mallard and Chatelier visualized as flame propagation " by conduction " is an ideal condition perhaps realizable only when a stagnant explosive mixture is ignited without im-

pulse at the centre of a spherical vessel of infinite radius. Important new information has been obtained regarding the influence of " compression " and " shock " waves upon the speeding-up of combustion and flame movements during explosions, and it is now proved that its speed can be abruptly raised from a lower to a higher uniform value when a flame is overtaken by a " shock wave " travelling in the same direction. Indeed it has been shown that in such manner the flame speed can be successively raised *per saltum* many times, and that it may assume any uniform value between the limits of that theoretically corresponding with propagation by conduction, and that due to propagation by adiabatic compression.

Much new light has been thrown on what may be termed the " pre-detonation " phase of explosion, when the flame is advancing at a speed greater than that of any shock wave through the unburnt medium, and is therefore, overtaking any such shock waves which are ahead of it. Photographs were exhibited showing how detonation is ultimately set up when a rapidly moving flame on the verge thereof is just about to overtake a shock wave immediately in front of it. These discoveries have necessitated some revision of the old classic conception of detonation.

Within recent years the photographic method has also been used for the purpose of analyzing (i) ignition phenomena, including the " induction period " of explosions, (ii) the influence of moisture upon explosions of carbonic oxide-oxygen mixtures, and (iii) the influence of strong electrical fields upon gaseous explosions; and some results of such analyses were shown by Prof. Bone.

Coal: Smokeless Fuel and Oil from the National Standpoint

By Dr. W. R. Ormandy.

[Paper before the Institute of Fuel, Oct. 7]

[Extract.]

Hydrogenation of Coal by I.C.I.

If hydrogenation were to become an industry in this country, it were clear that it must be applied to the conversion of coal into oil. Sir Harry McGowan, Chairman of Imperial Chemical Industries, Ltd., has stated that they have a semi-commercial unit capable of dealing with about 15 tons of coal per day, and they claim that the experience gained with this plant is of such an order that they would be justified in proceeding with a large-scale commercial unit for the production of 220,000 tons of petrol per annum. Just as in Germany, the experience which the I.G. have gained in pressure plant technique has eminently fitted them for work on hydrogenation of lignites and their distillates, so I.C.I.'s experience on similar lines marks them out for similar advances in this country.

To convert coal into oil necessitates the addition of some 10 p.ct. of hydrogen to bring about the transformation. This means that to convert a quantity of coal into a ton of petrol at least 40,000 c.ft. of hydrogen will be necessary. No one in this country has such experience of the production of cheap hydrogen on a large scale as Imperial Chemical Industries, Ltd. It is stated by this Company that, at the present price of coal, they can convert coal into petrol at an overall cost of 7d. per gallon of spirit produced.

Coal Requirements.

Considerable amounts of coal are required over and above that passing through the autoclaves which is undergoing actual conversion. It may be assumed that for every 1⅔ tons of coal passed through the autoclaves approximately 2½ tons are necessary for all other purposes, including the provision of power which is used for compressing the hydrogen, grinding the coal, mixing the coal and oil and forcing the mixture into the pressure system. In addition, heat is necessary for raising the oil-hydrogen mixture to the temperature at which the reaction takes place, and still larger quantities of coal are required for the manufacture of coke from which water gas and eventually hydrogen are produced. To make 1 ton of petrol, approximately 4 tons of coal are necessary in all. Our national requirements for petrol amount at present to approximately 3,500,000 tons per annum, and to displace this, 14,000,000 tons of coal would be necessary.

It must not be assumed that in one passage through a catalyst chamber practically the whole of the coal can be converted into motor spirit. The product of the first reaction will contain oils from low to high boiling-point, and if petrol alone is desired the heavy fractions mixed with fresh coal are put through the plant a second time. It has become customary to regard the problem of converting coal into oil as being in fact essentially one of converting coal into petrol, but it has to be remembered that much larger weights of mineral oils in the form of Diesel engine oil and fuel oils are used in this country than the total weight of petrol. Fortunately, as stated above, heavy oils can be produced by hydrogenation just as easily as, or more easily than, the more volatile qualities, and by variation of conditions it is possible to alter the ratio of the products within a wide range.

Quality of Petrol and Heavy Oil Fractions.

Questions will be asked as to the nature and quality of the petrol produced by hydrogenation of coal; but the answer is obviously not simple, for according to the conditions of work, quality in relation to quantity can be varied over wide limits; nevertheless, it may be said that, assuming the plant is running to produce the maximum amount of motor spirit, such average motor spirit would have an octane number of 81. Which, put into more easily understandable terms, means that the spirit would be about equivalent to a mixture of equal parts of motor benzole with an average straight-run American spirit. This means that, from the anti-knock standpoint, the spirit would be as good as, or better than, the spirits commercially available to-day. As the oils produced by hydrogenation are remarkably free from unsaturated products, they are easily and cheaply refined, and during refining, losses are low.

The heavier oils for fuel purposes would have a heat value more commensurate with mineral fuel oils than with the oils produced by the fractional distillation of low-temperature tars, but no information is available as to their specific gravity and viscosity. As to the suitability of what might be called the Diesel engine oil fractions one question must be raised. The very property of hydrogenized petrols which makes them particularly valuable—namely, their high anti-knock properties due to their large content of aromatics and naphthenes—counts against a Diesel oil, the Diesel engine preferring a fuel having a low spontaneous ignition temperature, so that it can be worked to give self-ignition at the lowest possible compression. The London General Omnibus Company have run small high-speed Diesel engines with success on gas-works creosote, and it is fairly certain that the spontaneous ignition temperature of these will be higher than that of the corresponding oils produced by the hydrogenation of coal.

Pro-Knockers in Diesel Fuel.

American researches have led to the discovery of a product—tetra-ethyl lead—which, if added to motor spirit in the proportion of 1 part in 1500, sends up the anti-knock value of a petrol to a degree equivalent to the addition of about 30 p.ct. of motor benzole. It is eminently desirable that some substance should be discovered having exactly opposite properties—namely, one which, when added in traces to aromatic or phenolic oils, would reduce the spontaneous ignition temperature, and thus render them more suited for high-speed Diesel work. In the writer's laboratory scores of products have been tried, but nothing better than nitro-benzole and amyl-nitrate have been found, nor have any relationships been discovered which might lead one to think that success could be arrived at by working along some definite line. It was found that 1½ p.ct. of nitro-benzene reduced the spontaneous ignition temperature of a standard meta-cresol sample by 43° C., and 1 p.ct. of amyl-nitrate brought about a reduction of 59° C. These results are in no wise comparable in degree with those produced by tetra-ethyl lead.

Elsewhere in this paper the position of the oil world is discussed, and it is pointed out that the state of affairs

obtaining at present in this country cannot possibly continue. The price of oil must rise eventually to an economic limit.

It is to be assumed that if the coal-oil industry is to be developed in this country, the first works would be put down somewhere in the Midlands most suitable for the supply of cheap raw material, and with a view to the cheapest possible distribution of the finished product. The production figure which has been discussed in the Press of 220,000 tons per annum corresponds to approximately 60,000,000 gallons, a quantity large enough to need a fair-sized distributing organization. This raises the point as to whether the suggested unit is regarded as the smallest desirable, because, from the distribution point of view, three units for the same output would be in this respect better. No doubt this side of the subject has received adequate consideration. Obviously, the overhead costs on the larger unit would be lower, and it is well known that the cost of hydrogen production is largely bound up with the size of the unit.

Economics of Coal-Oil Industry.

In addition to the cost per gallon, interest centres on the capital outlay involved, and a figure of £8,000,000 has been mentioned. This sum is arrived at on the assumption that an entirely new works is started, and includes the cost of land and sidings, buildings and plant, bunkers, and storage, and makes allowance for the reserves which are desirable, and indeed necessary, in considering the lay-out and starting of a new industry. The sum of 7d. per gallon covers depreciation varying from 15 p.ct. on those parts of the plant most liable to deterioration, down to 2½ p.ct. on buildings. At the present sale price of petrol, assuming 2d. for distribution charges and 2d. for the retailer, no profit can be made; but, as stated elsewhere, the present situation cannot last, and even before such a unit could be erected circumstances may have altered radically.

At present the problem is one of political economy. That it is desirable that this country should be in a position to produce its own light volatile fuel is obvious, and what is even more obvious is that the nation should have proof on a commercial scale that the problem has been solved, and that in case of necessity production could be increased. Assuming that the motor spirit produced by hydrogenation from coal were not taxed, then under the present conditions the State would lose £1,750,000 in duty, but an additional 900,000 tons of coal would be necessary, which would find employment for 3000 additional miners, and obviously the provision of the necessary plant would find temporary work for many more.

It must be conceded that seldom has a new process endeavoured to find its way into the commercial world at a worse moment.

Bye-Products of Coke-Oven Industry.

We have to recognize the fact that for some time to come the coking industry has to look to coke for its main return, and to gas in the second place. The prospects for an improving yield from oils and ammonia are not cheerful. As difficulty is being experienced in disposing of the heavy liquid products from the high-temperature distillation of coal at encouraging prices, it has been suggested that the comparatively new process of hydrogenation should be approached for the solution of the difficulty.

A small proportion of the hard coke produced in coke ovens is being broken and sized and supplied to markets which have hitherto been held by anthracite and gas-works coke. To a certain extent, well-sized coke oven coke can take the place of anthracite in slow combustion stoves, and can also be used in central heating installations, and the competition between gas-works and coke oven coke seems likely to grow.

Gas Industry.

In spite of the growing strength of feeling that the smoke nuisance is one which should be abated, it is still true that gas-works have difficulty in disposing of their coke. This is due to a number of causes. The grates in most of the existing pre-war built houses are of the old bar type, persisting down from the period of cheap coal and used by people accustomed to burning coal in them, who are, moreover, very conservative in their habits. Further, until comparatively recently no real effort was made to break and grade gas-works coke into standard sizes, and, as will be shown later, the ignitability and steady burning of coke in bar grates are to a considerable degree dependent upon the size of the coke. Cleanliness in the coal employed in the gas-works has not always received the attention it deserves, and the ash in the coke has, in consequence, often been high enough to be detrimental. Finally, the quenching of the coke as it leaves the retort has often led to a product containing an amount of water which caused the coke to be difficult of ignition.

The main objection which has been raised against gas-works coke is undoubtedly the difficulty of ignition and its slow combustion, due to lack of draught in the average grate. The tendency to install modern hearth grates is making the utilization of gas-works coke more possible, and the Gas Industry is rapidly adapting itself to new requirements. For central heating this coke is an admirable fuel, and there is little doubt that the process of education which the public is now undergoing will lead to increased utilization of the cleaner and drier graded cokes now available.

The conversion of coal into coke results in a diminished weight of solid products, so much so that the resulting coke may be taken as weighing about 70 p.ct. of the original coal. On analysis, it is found that the percentage of sulphur in the coke is generally slightly lower than the percentage in the original coal, but this reduction is only of the order of 10 p.ct. Obviously, if we are going to burn as much coke as we previously burnt coal, the total sulphur fumes turned into the atmosphere are only reduced by 10 p.ct. From this point of view the gain is not great. The utilization of coke, however produced, entails the production of gas which is sold to the public in a highly purified condition. It is estimated that not less than one-third of the total sulphur contained in the coals which are carbonized by the Gas Industry is removed as sulphur in the iron purifiers.

There is, however, very little doubt that the presence of smoke fog with its oil contents does lead to local concentration of acid, and that the dirt film deposited enhances the action of the sulphur bodies carried down with it. In a smoke-free atmosphere it is highly probable that the sulphur compounds present would be more rapidly dissipated than is the case at present, but it must not be assumed that smokeless fuel means an end to the sulphur trouble.

The present price which motor benzole fetches is entirely artificial, in that it is not subject to the excise duty paid on imported motor spirit. There remains the premium price addition due to the high anti-knock and heat value which attaches to this fuel. In view of the very unstable nature of the high excise duty at present imposed, there is not much prospect that there will be any considerable increase in the recovery of motor benzole from town gas, in the smaller works, though the large works are rapidly increasing the volume of gas treated.

Household Smokeless Fuel.

(*a*) *Ash.*—Before discussing the production of smokeless fuels suitable for household use, it would be well to consider the properties which such a fuel should have. In the first place it should be low in ash, and the figure of 8 p.ct. may be regarded as a maximum. One of the claims made by some makers of smokeless fuel is that they are able to employ the colliery slacks which are available at present in considerable quantities at low prices. It is evident that to get a maximum of 8 p.ct. in the coke about 6 p.ct. only is allowable in the coal. The nature of the ash, too, plays an important rôle, and it is difficult to assess the effect of ash content in any specific terms. Some ashes left after combustion of the fuel are light and voluminous, and others comparatively dense. A smokeless fuel made from a coal high in a light type of ash, after burning for a short time becomes covered with a layer of ash, which is not only unsightly, but which considerably reduces the radiant heat thrown out by the fire. These light ashes have the serious disadvantage that when the fire is disturbed they tend to get into the room with very unpleasant consequences. Other things being equal, coals giving dense ashes are preferable for the manufacture of household coke.

(*b*) *Ease of Ignition.*—Another property which must receive serious consideration is that of ease of ignition.

(*c*) *Dryness.*—Another necessity for a satisfactory household smokeless fuel is dryness. The effect of increasing the moisture from 4 to 16 p.ct. adds 50 p.ct. to the heat units necessary for ignition. Wet coke gives an intense fire for about 45 minutes, whereas a comparatively dry coke gives an intense fire for about 120 minutes. The increase in moisture content decreases the maximum rate of radiation roughly in direct proportion to the moisture increase, and it increases the rate at which the rate of radiation decreases after the maximum has been passed. The size of the fuel is also a matter of importance. The optimum size of low-temperature coke to give the most active fire in the well-type of grate is from 1½ in. to 2 in.; and in the bar grate, from 1 in. to 1¼ in. Using gas coke in both the well and bar grates, the optimum size was found to be 1 in. to 1½ in.

(*d*) *Density.*—Household coke should be as dense as is practicable, having regard to the other requirements. This point affects carriage and storage. There is need for some accepted standard test for measuring the resistance of

cokes to abrasion such as arises in transport and loading and unloading at wharves and in the house. The shatter index tests are not very useful with low-temperature products, most of which yield a high figure. What is required, in effect, is some test which will give a measure of the tendency of the cokes to produce breeze and dust.

(*e*) *Sulphur Content.*—That cokes should be as low as possible in sulphur is obviously desirable.

(*f*) *Reactivity.*—This clearly plays an important part in the behaviour of the cokes produced by the distillation of coal at comparatively low temperatures. Important as are the researches which have been carried out on this subject, and valuable as the results will eventually prove to industry, at the present time the experimental data obtainable by the Fuel Research Division's test is of greater practical interest. We must recognize that it is possible to have a coke which is too reactive, and which would give too intense a fire, for normal purposes, leading to frequent refilling and high consumption. Although considerable control over the rate of burning can be gained by selective sizing, it is unfortunate that optimum results in this respect vary with the type of grate employed.

Just as different qualities of household coal are purveyed, so there seems every probability that smokeless fuels, having different qualities, will find different markets. The lower the temperature at which a coke is formed, the higher the amount of volatile matter left in the coke; and there is little doubt that the presence of this volatile matter has some bearing on the question of the readiness with which the fuel can be ignited. Some very recent experiments carried out at the Northern Polytechnic have shown that, when a coke has been made at a low temperature, and subsequently heated to a higher temperature to drive off the volatiles contained in it, the resulting coke is more reactive than the coke would be if made from the same coal in one heating at the higher temperature employed in the reheating.

Weight Value of Smokeless Fuel.

A question of very great importance now arises when regarding the possible replacement of household coal by smokeless fuel. Assuming in round figures that 100 tons of coal give 75 tons of smokeless fuel, will the public have to purchase 100 tons of smokeless fuel to obtain the same result as they would when burning coal? The answer is distinctly in the negative, but it is difficult to fix a ratio between the values, weight for weight, of average coal and average smokeless fuel. Experiments on this point have been carried out at the Fuel Research Division, results being obtained in favour of smokeless fuel to the extent of 15 to 30 p.ct. smaller fuel consumption. For the purpose of our discussion, we may assume that 20 p.ct. less coke would be necessary to give the same heating effect as would be necessary if coal were employed. This means in effect that to displace the 40 million tons of household coal at present estimated to be used by 80 p.ct. of its weight of smokeless fuel an additional 3 million tons of coal would be needed to produce the required coke. From this point of view, then, the campaign for smokeless fuel is not likely to lead to any considerable increase in coal production, but it does carry with it certain serious implications. At present, household coal is for the most part large coal sold by the collieries at a price considerably in excess of that charged for slack, and considerably above the average price of the coal raised. It is difficult in this matter to give average figures, since the price varies from colliery to colliery according to the quality of the coal produced, and it varies, moreover, with each commercial size sold. Taking a specific case, a very large colliery sells household coal at 21s. per ton free on rail at the pit, whereas the slack from the same coal seam passing through a 1¼ in. screen is sold at the pit for 7s. 6d. per ton. It is in effect as though the slack were subsidized at the expense of the purchasers of the large coal, because the average production cost of through and through coal as raised is about 13s. 6d. per ton. If collieries are to be deprived of a 40 million ton market for the product bringing them the highest price (even under these conditions they are losing some pence per ton on an average), it is obvious that the price of slack would have to be increased. If smokeless fuel is to be generally employed—and admitting that it is only necessary to purchase 20 p.ct. less smokeless fuel—are the public prepared to pay 20 p.ct. more for the added form value of their new fuel, or can an even greater price be asked? One thing is certain, that in the development stages of the smokeless fuel industry there will be a price war, for the collieries will not willingly relinquish their most profitable market.

Transport and Storage of Smokeless Fuel.

If smokeless fuel is to be produced at or near the source of the raw material, the problem of carriage arises. To-day the average railway truck carrying coal moves slightly more than nine tons per truck per journey; but smokeless fuel occupies twice the space weight for weight, and the railway companies will be faced with another problem. The trade in household fuel is essentially seasonal. At present coal is mined faster or slower as the demand rises or falls; but if a smokeless fuel is to be provided in place of coal then the works manufacturing such smokeless fuel will either have to have a peak load capacity or work into stock during the summer months. The storage of coal in large quantities is a serious enough problem, but the storage of a light coke occupying twice the space is even more serious. In the handling of coal into and out of storage, quite appreciable amounts of smalls are made, but it is to be feared that this percentage would be higher in the case of coke. Experiments have been cited to show the great and deleterious influence exerted by water in diminishing the value of cokes in general. Unfortunately cokes suitable for use as smokeless fuel are very absorbent and take up water much more readily than they give it out. Even in the ordinary course of transport from the smokeless fuel factory to the distributors, our English summers, not to mention winters, could do considerable damage, and if storage is to be employed for the equalization of production to meet varying demands, covered storage would be essential. There are other minor points in connection with distribution which are of importance. To-day in hundreds of small sidings a few wagons of coal stand in the open to provide for local requirements, or the contents of a wagon or two are discharged into a heap by the rail side to be used as required, and seldom is there any cover provided. Again, modern small houses and still smaller flats have comparatively little fuel accommodation, and the use of a smokeless fuel would doubtless necessitate more frequent deliveries.

So far, we have dealt with the problem of smokeless fuel manufacture from the coke point of view, but when coal is converted at low temperatures into smokeless fuel, oils and gases are formed.

Gas from Low-Temperature Carbonization.

Just as in the case of the gas-works and the coke ovens, the amount of gas produced varies with the temperature and the nature of the plant employed. Externally heated retorts at a low temperature give a minimum volume of gas of high calorific value. As the temperature increases, the amount of gas increases, and the calorific value diminishes; but the aggregate heat value of the gas produced increases. Where carbonization is carried out by means of processes employing internal heating, still larger volumes of poorer gas are generated; but here again the aggregate of heat units contained in the gas is higher than in the case of the externally heated retorts. Again regarding the problem from the point of view that smokeless fuel is to displace the burning of raw coal for household purposes, 43 million tons of coal will have to be carbonized to produce the requisite quantity of smokeless fuel. For the purpose of this calculation we will assume that the gases from a ton of coal carbonized contain 32 therms, and that 15 therms are available over and above that required on the plant itself. The 43 million tons at 15 therms per ton give us an available surplus of 645 million therms. The Gas Industry carbonized about 18 million tons, with an average production of at least 75 therms making 1350 million therms. In other words, at the very lowest estimate, the replacement of 40 million tons of household coal by 32 million tons of smokeless fuel would lead to an added production of combustible gas having a heat value equivalent to about one-half of that produced by all the gas-works in the country. If all the coke ovens were brought up to modern standards, there would be an available production of gas equal to about one-third of the gas-works production; but the problem of the disposal of the gas produced by low-temperature distillation is much more serious than is the case of the coke oven gas, since the latter is practically the same in composition as town gas, whereas the gas produced by low-temperature distillation varies enormously from process to process.

Those who advocate low-temperature distillation of coal on a large scale refer to the possibilities of getting rid of the gas by passing it into some hypothetical ring-main system. The report of the Area Gas Committee impresses the necessity for coke oven gas, having an agreed-upon B.Th.U. content within the limit of plus or minus 4 p.ct. After a careful examination they were only able to recommend the provision of a ring-main in one area of this country, and that on the assumption that coke oven gas alone be taken into consideration. No ring-system could possibly exist, if supplied at a number of points with gas of varying thermal quality. One-sixth of the town gas supplies consists of water gas, which has to be enriched, and for the purpose of this enrichment 58·3 million gallons of imported gas-oil are used. If the production of low-temperature coke were carried out at or near the gas-

works, then the rich gas produced by low-temperature distillation might be employed in place of the gas-oil for enrichment purposes. As long ago as 1913, the late Sir George Beilby stated that the proper nursery for low-temperature distillation processes was the gas-works, but in view of the gas and coke problems involved, it begins to appear as though the gas-works were to be not merely the nursery, but the proper home for the full development of low-temperature carbonization.

Low-Temperature Tar.

Though the volume of gas produced by low-temperature distillation is smaller than that evolved in high-temperature distillation, the tar produced is greater in volume, and may be roughly taken as double. For the purpose of our discussion we will assume a somewhat high figure of 20 gallons of tar per ton. The character of the tar, like that of the gas and coke, varies with the temperature and conditions of its production, and if the process employed be really a low-temperature one, working below 600° C., the tar will have the characteristics of a primary tar. It will contain little or no aromatics, be rich in phenolic content, and contain possibly twice as much spirit distilling below 180° C. as a high-temperature tar. There may be about four gallons of motor-spirit fraction obtainable from the tar and by stripping the gas, but this spirit will be less valuable than the high-temperature spirit, in that the absence of aromatics reduces the anti-knock capacity and consequently the value. Low-temperature spirit also contains considerable quantities of unsaturated bodies and is, in consequence, comparatively expensive to purify, since more chemicals are required for the purpose and the percentage loss is higher. The enhanced production of tar renders the question of the value of the tar more important than is the case with the Gas Industry.

The market for phenolic and cresylic distillates suitable for use in wood impregnation is already more than fully satisfied. Valuable research upon the characteristics of this new product is being carried out, and in the course of time doubtless new and valuable products will be isolated therefrom. It can hardly be expected, however, that this development will have any very serious influence on the immediate large-scale development of low-temperature distillation. It is frequently suggested that subsidiary industries which may arise out of the treatment of the new bodies undoubtedly present in low-temperature tars, may be of considerable help to the new industry. It is worth pointing out that considerably more than 50 years' research has been applied to the discovery and utilization of the bodies contained in high-temperature tars, and the vast dye and drug industries have been built up on this basis. Nevertheless, the fact remains that of the whole world's production of tar, not 10 p.ct. is used directly or indirectly in the chemical industry, and if the benzole and toluol produced by high-temperature distillation in this country were dependent upon the chemical market the prices would be a mere fraction of those obtaining to-day. If new products were discovered in primary tars capable of being worked up industrially, and primary tars were produced in the quantity they would be, should smokeless fuel become a really national industry, even then years would elapse before the demand for these would be large enough to affect the bulk price of the raw material. The suggestion which has frequently been thrown out that works producing low-temperature coke should work up their own bye-products to the stage of producing finished chemicals will not stand examination. Comparing the old-established Gas Industry, we find that the gas-works produce tars and distil them for the production of pure benzole and toluol, and also produce naphthalene and a few other products, but they do not attempt to convert these raw materials into dyes and drugs. These are industries which look to the gas-works as the purveyors of their raw materials, and a similar evolution would have to be gone through in relation to primary tars.

Markets for Low-Temperature Tar.

While we are waiting for the scientists to find out new products for which primary tars can serve as a basis, what markets are available? The first and most obvious is fuel oil. To make an acceptable fuel, the crude tar would have to be topped and distilled, and products would be produced having characteristics such as are given in the following table, from which it will be observed that the gross calorific value per lb. is about 16,800 B.Th.U., omitting the last two samples produced by the distillation of cannel coal.

These oils would be competitive with mineral oils averaging 19,000 B.Th.U. per lb. gross. Clearly weight for weight low-temperature tar oils are worth less than imported fuel oils. Looking at the matter from the point of view of its use in oil-fired ships, the calorific value per unit

Sample.	Specific Gravity at 60° Fahr.	Calorific Value. B.Th.U./Lb. (Gross).	Calorific Value Unit Volume.
1	1·0145	16,780	17,020
2	1·01	16,880	17,040
3	1·015	16,830	17,040
4	0·9895	16,830	16,550
5	0·992	16,780	16,640
6	1·0185	16,580	16,890
7	0·913	18,310	16,710
8	0·9085	18,240	16,570
			Mean = 16,810
Corresponding Figures for Mineral Oils for Marine Purposes.			
1	0·955	18,810	17,960
2	0·895	19,060	17,050
3	0·915	19,000	17,380
			Mean = 17,460

of volume has to receive consideration, and even here, as the table shows, there is a slight balance in favour of mineral oils. It must be admitted that comparison on gross heat values is unfair because, whether the oils be used in Diesel engines or burnt under boilers, it is the lower heat value which really comes into comparison, and if allowance be made for the lower hydrogen content of the tar oils, it may be said that, volume for volume, they are about equal to mineral oil. The weight of oil to be carried, for equal results, however, would be in favour of the mineral oils, owing to the higher gravity of the tar oils. Regarded as a Diesel engine fuel, oils rich in cresylic bodies are distinctly at a disadvantage. From the foregoing it will be gathered that low-temperature tar distillates for fuel purposes are intrinsically worth less than mineral fuel oils.

Hydrogenation of Low-Temperature Tar.

The only other outlet which has been suggested for topped low-temperature tar is hydrogenation for conversion into motor spirit. One of the main expenses in the conversion of coal into oil by hydrogenation is the cost of the hydrogen. The hydrogen content of low-temperature tar oils is very much higher than that of coal, and it has been found in practice that little over one-half of the hydrogen is necessary for the conversion. Generally speaking, it can be said that low-temperature tar oils are easier to hydrogenate than high-temperature tar oils, that is, that the rate at which the raw material can be hydrogenized is greater in the one case than in the other. The fact that low-temperature tars are comparatively free from so-called "free carbon" and low in asphaltic bodies simplifies their conversion by hydrogenation. The end products obtainable by hydrogenation of either low temperature or high temperature tar oils are very similar. A light creosote oil has been found on hydrogenation to give a yield of about 100 volumes of product per 100 volumes of raw material, but the gravity of the finished product was only 80 p.ct. of that of the original raw material employed. The resulting spirit contained:

Unsaturateds	1·6 p.ct.
Aromatics	57·0 ,,
Naphthenes	24·5 ,,
Paraffins by difference	16·9 ,,

with an end boiling point of 180° C. A motor spirit having such a constitution would be far superior in anti-knock character to the imported motor spirit generally available.

Coming now to the economics of the situation, what has been said regarding the conversion of coal into oil very largely applies. Obviously, the price which can be paid for the low-temperature tar is more per ton than is paid for the coal, for whereas it is necessary to provide 4 tons of coal to produce 1 ton of motor spirit from coal, a smaller quantity of coal will be necessary to supply hydrogen, heat and power for the conversion of low-temperature tar, but it is very doubtful whether a higher price than £2 per ton would be realizable. It has been suggested that low-temperature tars should be subjected to a cracking process, such as is applied to mineral oils for the production of motor spirit, but experiments in this direction have so far not proved encouraging, and it is very doubtful whether oils rich in tar acids will ever prove amenable to this treatment.

Future of Low-Temperature Industry.

There would appear to be very little prospect of low-temperature tars fetching more than 2d. per gallon in the next few years, and it is difficult to see any prospect for a profitable outlet for low-temperature gases. If the gases have to be burnt in competition with coal for steam-raising, they are worth about ½d. per therm, and the only market for them, where their form value would increase to (say) 2d. per therm, is in the town gas industry as enriching gases, and this carries with it a corollary that the works should be in or adjacent to an existing gas-works. That an isolated smokeless fuel works should prosper when

favourably situated near a suitable source of raw material is clear, so long as they are able to buy suitable clean slack at a price which is in effect subsidized at the cost of users of round coal for household purposes, and are able to sell their solid finished product at a price as high as, or even higher than, that at which household coal is sold. However, this is no basis for building up a national industry, nor can it be regarded as rationalization in any real meaning of the word. If a smokeless fuel plant be installed in a gas-works, then not only can the gas-works use the excess high value gas for enrichment, but they can provide the heat necessary in the smokeless fuel process in the form of producer or other gas of low calorific value, and thus set free more of the high value gas for enrichment purposes.

Even if smokeless fuel for household purposes is of necessity to be made by low-temperature processes, the weight of evidence would seem to be in favour of the erection of such plants at a gas-works, not only for the reasons just mentioned, but from the fact that the gas-works are situated of necessity in populous centres where they already have selling organizations for their own bye-product coke. This brings up the question as to whether the gas-works process can be modified in such a way as will give a fuel which, while not quite comparable with coke made at a really low temperature, has, nevertheless, a sufficiently low ignition temperature and is otherwise satisfactory. In so far as horizontal retorts and chamber-ovens are concerned, the problem would not seem to be insoluble, though it may involve the blending of fuels and modifications in other directions. At large gas-works the provision of more than one class of coal brings with it very real difficulties, but it still leaves the possibilities of a combination of the low and high temperature operations referred to elsewhere. Some of the gas-works coal could be treated by a low-temperature process, the high calorie gas being used for enrichment purposes, and the low-temperature coke sized and the fines used for admixture in blending operations. Experiments along this and similar lines are being actively prosecuted. The gas-works undoubtedly realize the importance of the problem which lies before them.

It has been suggested by no less an authority than Sir Richard Redmayne that the proper development of low-temperature distillation should be carried out in conjunction with the great electric power stations now being established, because thereby an immediate outlet for the surplus gas and the fuel oil would be available. Further, such smokeless fuel as did not find a household market could be burnt under the boilers of the power station. This is tantamount to saying that the proportion of the original coal which is converted into gas and oil shall be sold at the price of the coal from which it is made. A power station cannot afford to give appreciably more for these fuels than for the same number of heat units in the form of coal, since modern boilers such as are installed in new power stations already have an efficiency of over 85 p.ct. There would be no appreciable saving in labour, though there would be added complications due to the application of gas and oil fuel in addition to solid fuel. Moreover, it is proposed that that proportion of the smokeless fuel which is not sold to the public shall also be burnt under the boilers, but this again would be worth no more per ton than the coal from which it was made, since the heat units in the coke are generally the same as those in the original coal, unit for unit of weight.

This leaves us in the situation that the cost of running the plant with interest and depreciation has to be borne entirely by that proportion of the smokeless fuel which finds its way on to the household market. Each case would have to be considered on its merit, but there would have to be a very considerable difference between coal costs on the purchase side and smokeless fuel costs on the sale side, if a fraction of the latter is to bring in a profit on the venture. Doubtless there are a few situations with cheap slack of a suitable type for coking and a near market for the oil and gas as fuels available, where the bulk of the smokeless fuel can be sold locally at a price sufficient to show a margin of profit. The number of such cases, however, will not be adequate to make a national industry.

[The discussion on the paper is held over until next week.—ED., "G. J."]

North of England Gas Managers' Association

The Autumn Meeting of the North of England Gas Managers' Association was held at the Grand Hotel, West Hartlepool, on Friday, Oct. 9. Some eighty members, from as far south as Hull and as far west as Carlisle, attended. The hotel ballroom, converted to a lounge for the occasion, gave the meeting a delightful social atmosphere.

Mr. J. R. Bradshaw, B.Sc.Eng., M.Inst.Gas E., Engineer, Manager, and Secretary of the Hartlepool Gas and Water Company, President, was in the chair, and introduced Mr. J. Stanley Appleby, J.P., of Darlington, Chairman of the Company, and called upon him to open the meeting.

Welcoming the members to Hartlepool, Mr. APPLEBY said that he could say as Chairman of the Hartlepool Gas and Water Company that the Company felt honoured that the Association had elected their Engineer as its President. He was an able and most efficient official and a worthy friend. They met in extraordinary circumstances. At least he hoped that they were extraordinary. He doubted whether any of them could recall when conditions were so full of dangers and difficulties as to-day. Whether they spoke as one of the peoples of the earth, or as the British people, or as individuals, could they point to any other time in the world's history when conditions were so full of danger? Yet who among them would change the plight of this country for the plight of any other country in the world? The same applied to gas and water. Who would change the troubles of the Industry for those of other industries in this country?

He would like to apologize for the absence of the Board of Directors of the Company, but two had been called away on business, and a third was unwell. As Chairman, however, he wished to welcome them most heartily, and to express the hope that when next year Mr. A. C. Hovey, of London, followed their Engineer as President of the Association, he would have a most successful year of office, and, finally, that their deliberations that day would be most profitable.

Mr. F. P. TARRATT, Engineer of the Newcastle-upon-Tyne and Gateshead Gas Company, responded, and said that they appreciated Mr. Appleby's good wishes on their visit to Hartlepool, which, he believed, was the fourth occasion on which the Association had met in the town. Mr. Bradshaw was following in the footsteps of many able men. In him, the Company had an excellent man.

The PRESIDENT announced the election of the following: *Member*—Mr. William Turnbull, Alnwick Gas Company. *Associate Members*—Mr. Richard Atkinson, Newcastle and Gateshead Gas Company; Mr. Philip Norman Lee, Hartlepool Gas and Water Company.

A number of students were presented by the President with Higher Grade Certificates in Gas Engineering.

PRESIDENTIAL ADDRESS

of Mr. J. R. BRADSHAW, B.Sc.Eng., Engineer, Manager, and Secretary of the Hartlepool Gas and Water Company.

In the first place, please allow me to thank you for the honour you have put upon me in electing me as your President. I am deeply conscious of the solemn responsibility attaching to my office, of the traditions of our Association and of our Industry, of the care to be exercised in following the long line of worthy Presidents whom I have the task of emulating, men who achieved outstanding successes in those difficult days when knowledge was held by the few; and I am proud of the confidence you have placed in me. It is particularly pleasing, too, that this honour should have come my way after such a short time among you, and I wish to take this my earliest opportunity of thanking you for the welcome I received from one and all in the Association only four short years ago. Words cannot express the value of the friendships I have made, and I have the highest appreciation of the help I have received and the knowledge I have gained by contact with you at our meetings, and in particular at the monthly meetings of the Special Purposes Section; the value of which it is impossible to exaggerate, and without which we and our undertakings would be much the poorer.

SOME FORMER PRESIDENTS.

It is significant that I am the fourth President from the Hartlepool Gas and Water Company, the first being Mr. Thos. Trewhitt, the then Secretary and General Manager of the Company, and it is a remarkable coincidence that on this corresponding Friday exactly 50 years ago (Oct. 7, 1881) Mr. Trewhitt should read his Presidential Address at West Hartlepool, when the Association held its ninth half-

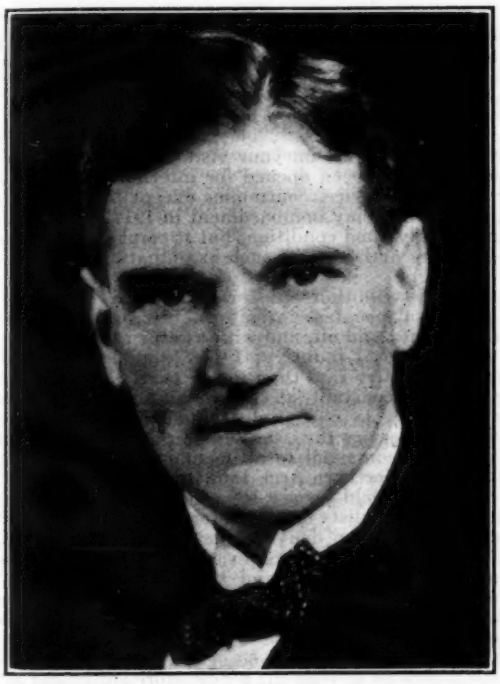
yearly meeting. The following is a quotation from the report in the "GAS JOURNAL" the following week:

> "Light refreshments were served in the water tower which was ornamented for the occasion with a profusion of choice foliage-plants and ferns, and was gay with red and white striped hangings. In the centre of the building was a framed couplet from Tennyson ('revised'): 'The electrical spark may come and go; but gas goes on for ever.'"

The burden of Mr. Trewhitt's address was twofold—

(1) His belief in the future success of gas as the general illuminating agent of this country.
(2) His urgent request to all gas undertakers to insert a clause in their respective Bills giving power to specify pipes and fittings of adequate size and appropriate quality "as gas is now used extensively for heating and cooking."

Mr. Hepworth, of Carlisle, was present and remarked that he was the only person present in addition to those associated with the Hartlepool Company who was connected with a combined gas and water undertaking. Now my Company is the only one in the Association. Mr. Sellers, of York, in the course of his remarks stated that they would all agree with him that there was nothing like gas—not even leather. He regarded electric light as a friend in disguise. What he found fault with was that certain promoters of the light should indulge in such palpable exaggerations and evasions of fact, both with regard to illuminating power and cost. How applicable to-day!



THE PRESIDENT.

J. R. BRADSHAW, B.Sc. Eng. (Lond.).

Mr. Bradshaw served his articles with the late Mr. Charles Harrison, the Engineer and General Manager to the Accrington District Gas and Water Board, and held in succession the following appointments: Chief Assistant Engineer, Doncaster Corporation Gas Department; Chief Assistant Engineer, Barrow Gas and Water Department; Engineer and Manager, Retford Gas and Water Department; and Chief Engineer, Plymouth Corporation Gas Department. He has been Engineer, Manager, and Secretary of the Hartlepool Gas and Water Company since 1927.

The next President my Company supplied was Mr. Thos. Bower, and his Presidential meeting was held at West Hartlepool on Friday, Oct. 12, 1888. Here again competition from electricity and oil was referred to, but perhaps the chief feature of his address was an appeal for standardization of sizes in our materials and appliances. But it seems to me that that meeting was a memorable one if only for the fact that our own Mr. Herbert Lees was on that day elected to membership as Engineer of the Workington Undertaking. It is impossible to estimate the influence Mr. Lees has had in the Association and its works, an influence as great and beneficial to-day as it has been for the past 40 years and more. Long may he be spared to give us the benefit of his advice so enriched by his ripe experience.

The next President was Mr. A. W. Branson, who was unfortunately removed from worldly activities in the prime of life four years ago. Again the Association visited West Hartlepool for his Presidential meeting, this time on Friday, Oct. 8, 1920. The chief items in his remarks were centred upon labour troubles, high wages, labour saving machinery, and benzole extraction.

WHEN COMPETITION WAS NEGLIGIBLE.

It is most interesting to re-read these addresses of former years, and much advantage is to be obtained by so doing. In these strenuous times we are apt to look with envy upon the times of our predecessors in office when competition was almost negligible, and to imagine that they must have had great difficulty in avoiding boredom, so serene must their lives have been. A review of contemporary literature, addresses, and presidential addresses shows how fallacious our impressions are.

At the same time I do think that our predecessors had much more opportunity to concentrate upon their own particular problems than we have to-day. How many of us have the time to be engineers in the proper sense of the word and to satisfy ourselves that each particular problem receives the expert and individual attention that its importance warrants? Is not too great a proportion of our time spent in ancillary and auxiliary duties and management as distinct from engineering? We are now so well equipped with an Association to deal with this, a Federation to deal with that, and a Council to deal with the other, that we find ourselves spending a large proportion of our working and rest hours attending one or other of these meetings and conferences, whereas we might on many an occasion be better occupied in settling down to our own domestic affairs and working out our own problems. I do not wish to belittle or decry in the slightest degree the importance and necessity of even the smallest or most insignificant of these organizations; but it seems apparent that co-ordination is necessary to a greater extent than obtains to-day. It is a pity that the representation on the committees and managements of many of our national and district organizations falls on such a relatively few shoulders, and I am convinced that if a wider range of personnel was appointed to the control of our organizations it would be better not only for the organizations but also for the individuals so taking their share of the burden.

I have no wish to make any provocative statement in this place for the unification or co-ordination of the various organizations which are caring for our national needs, as I feel sure those at the head of these bodies must be alive to the necessity of it. Nevertheless, I definitely throw out the suggestion that yet another committee consisting of not more than two members from each executive board of the Institution of Gas Engineers, the National Gas Council, and the British Commercial Gas Association might usefully be called together to consider the advisability of defining and limiting the scope of each organization.

CHANGES IN THE HARTLEPOOL COMPANY.

Looking back to the time when Mr. Trewhitt was President of this Association in 1881, one cannot fail to be impressed by the changes which have gradually taken place in the operations of my own Company, and it has been most interesting to me to follow the progress of the Company's activities, which has on the whole been one of success upon success. I give (p. 146) a table showing the receipts from the main headings of our revenue accounts and the percentage which each item bears to the total, at ten-year intervals.

The table is most interesting and brings into relief the part which each item plays in the scheme of things. (It should be noted that the 1920 figures are abnormal on account of the high prices obtained for coke in that year.) It is very clear that in spite of the undoubted benefits which are derived from the sale of residuals, gas (in the Hartlepools at any rate) is still called upon to contribute the major and an increasing proportion of our total income.

On broad lines I think I can safely claim that my Company has kept abreast of the times in its operations, both in manufacture and distribution, qualified all the time by the size of our operations and by the effect that any suggested improvement or modernization would have upon the ultimate service to the consumer and the selling price of gas. An inspection of some portions of our works may perhaps make this statement difficult to believe, but further consideration will make it more apparent. As far back as 1890, it was realized that the output of gas was increasing at such a rate that a new site would eventually be required. The whole of the gas was then being manufactured and stored on a very congested 5 acres of ground, and a further 25 acres was acquired nearly half a mile away with the object of transferring the whole of the works to

	1880.		1890.		1900.		1910.		1920.		1930.	
	Receipts. £	Percentage of Total.	Receipts. £	Percentage of Total.	Receipts. £	Percentage of Total.	Receipts. £	Percentage of Total.	Receipts. £	Percentage of Total.	Receipts. £	Percentage of Total.
Gas sold (in thousands c.ft.), excluding public lighting	81,472		186,355		344,277		341,606		436,733		464,415	
Gas sold, *less* discounts (excluding public lighting	13,001	60·6	21,659	57·6	45,032	62·9	38,075	64·0	61,876	42·6	88,042	73·8
Public lighting	3,454	16·1	5,041	13·3	6,753	9·4	3,264	5·5	2,234	1·5	3,176	2·7
Rental of meters	713	3·3	1,087	2·9	1,854	2·6	2,006	3·4	2,010	1·4	1,730	1·5
,, ,, stoves and lamps	..	..	228	0·6	505	0·7	726	1·2	1,633	1·1	..	..
,, ,, cookers and fires	..	..	..	..	..	..	..	..	..	..	5,063	4·2
,, ,, lamps	..	..	..	..	..	..	..	..	..	..	166	0·1
Coke and breeze	1,702	7·9	5,474	14·5	13,206	18·4	9,699	16·3	59,383	40·9	18,442	15·5
Tar	1,448	6·8	1,858	4·9	2,055	2·9	2,057	3·5	12,157	8·4	2,952	2·5
Liquor	1,047	4·9	..	..	..	..	..	..	..	..	..	..
Sulphate of ammonia	..	..	2,186	5·8	1,861	2·6	3,360	5·7	5,389	3·7	526*	0·4*
Carbon	..	..	4	..	81	0·1	85	0·1	89	0·1	95	..
Rents, &c.	89	0·4	163	0·4	293	0·4	188	0·3	431	0·3	142	0·1
	21,454	100·0	37,700	100·0	71,640	100·0	59,460	100·0	145,202	100·0	119,282	100·0

* Loss.

the new site. A 1-million c.ft. gasholder was erected, subsequently enlarged to take 1½ millions, a carburetted water gas plant erected, afterwards duplicated by means of a blue gas set (a waste-heat boiler was added later) with the necessary purifiers and station meter; a sulphate of ammonia plant was installed after the original one at the No. 1 works was destroyed by fire, and in later years a pan ash washer was put down to deal with the ashes from the coal gas producers at No. 1 works.

On the face of it, it seems that we ought to lose no time in concentrating our plant on the new site. There are undoubted advantages and economies to be obtained by so doing, and from the personal point of view nothing would give me greater delight than to erect a brand new works on the new site with all the latest systems and gadgets that most of us revel in, but we always get hard up against the cold fact that any advantages to be gained are entirely submerged in the cost of obtaining them. The cost would have to be borne by revenue account, and in the absence of a reserve fund for such an event, the present is not the time to saddle our consumers with increased charges, whatever might have been done in this way in the past. So we go on, as far as carbonization is concerned, content to take 70 therms out of each ton of coal and to have available for sale 10½ cwt. of coke, excluding breeze, until the return of more prosperous times on the part of our consumers, industrial and domestic.

Anxiety in Regard to Coke.

Coke is at present an anxiety due to lack of demand in Scandinavia, but we are trying to encourage better local sales, through co-operation with the local merchants. Hitherto we have not seriously attempted a direct service to the consumer, and even now I am not at all convinced that the job cannot be better done by the merchant, provided he is encouraged to do so by means of sliding-scale rebates based on tonnage. The difficulty here as in most districts covered by our association is that house coal is delivered relatively cheaply, and as regards the smallest and poorest consumers there is an extraordinary amount of sea-coal on the shore (to be had for the fetching) at most times of the year. At a time when we have so many unemployed, it is not to be expected that we can sell much coke to the poorer consumers under these conditions. In the absence of demand sufficient to keep our stocks of coke within reasonable bounds, we have resorted to an increased proportion of carburetted water gas, which serves our purpose very well, and with the recently reduced prices of gas oil and the necessarily low price of coke for shipment, the cost of carburetted water gas per therm into holder more nearly approaches that of the coal gas therm than for many years past.

Tar continues very depressed, and it is unfortunate that there are many highway authorities and their engineers who are still willing to use an imported product in road construction in preference to the home product which has never yet been surpassed in efficiency. If our own product were in any way inferior to its competitors we should be entirely wrong in protesting; but as it has at least equal merits surely it is not too much to ask that our own collieries, bye-product works, and gas-works should be encouraged by those very people who are so dependent on us for their rates and taxes.

Sulphate of ammonia is under a very dark cloud, and even under ideal conditions of working it is impossible to keep its cost of production down to the price received for it. Moreover, it is difficult to foresee any improvement until the consumption can be stimulated enormously and until the cost of acid can be very much reduced, or an alternative material successfully brought into general and satisfactory use.

A Veteran Gasholder.

An item of interest on your visit to the works is a gasholder which has been opened for internal inspection after over 50 years' service, continuous except for about a fortnight after an enemy bombardment in 1914. The holder is in surprisingly good condition, but it emphasizes the necessity for more and more of such examinations as time goes on.

On the distribution side, we continue to make surprisingly good progress in spite of increasing competition from electricity and oil, and with a return to more prosperous times in local industry, I feel confident we shall go ahead at a greater rate than in the past. This will not be done without constant alertness and endeavour; but we have confidence in our product, and with effective salesmanship and service the issue should not be much in doubt. Here I would commend to all members the desirability of joining in the Northern Area Industrial Gas Scheme. There is an enormous field for gas in industry, and while we cannot all keep specialists for the obtaining and keeping of this business, there is no denying the fact that a specialist is required. By co-operating in this scheme, the smallest undertaking has at command the use of an expert of a calibre which could never be hoped for working on its own resources, and the joining up with the scheme should be looked upon as being just as important as being a member of this Association.

With a view to serving our public more easily and attractively, new showrooms are on the point of completion, and we propose to hold regular lectures and demonstrations, and to encourage our consumers to pay their accounts and to bring their complaints there instead of to the offices. The advantage in so doing is too obvious to require emphasis here.

I cannot conclude without once more referring to the fact that the supply of water is included in my Company's activities, and while the opportunity does not present itself to visit our numerous outstations to-day, the pumping station and boreholes from which the whole of our supply of domestic water is taken can readily be seen in the site close to our No. 1 gas-works, and I am sure will prove of great interest. The advantages of a joint undertaking are very great, and it is a pity these advantages have not been more generally recognized and acted upon.

In conclusion, and reverting to the Gas Industry, we have a wonderful process, inherently sound in principle, and with a will to succeed in us and in our staffs and men, from the highest to the lowest, and with confidence in ourselves, the Industry need have no fears for the future. But a supreme effort is required from each one of us for the next few years until the public casts the scales from its eyes and once more returns to its proper sense of values, which it assuredly will. In the meantime,

Hats off to the past!
Coats off to the future!

Vote of Thanks.

Mr. T. P. Ridley, Secretary of Newcastle and Gateshead Gas Company, proposing a vote of thanks to Mr. Bradshaw for his Presidential Address, said that they could proffer their President the heartiest congratulations. He had only been among them for what was a comparatively short time, but they knew

a good man when they saw one. They quickly discovered that he always had something very useful to add to discussions, so that it was natural that they should not be slow to command his services. It seemed extraordinary that, fifty years ago that very day, a predecessor should have given a Presidential Address in West Hartlepool.

It was obvious that the electric spark had come to stay. If they said that gas went on for ever, it was true to say the same of the spark. He thought it very appropriate that their President should conclude with "Hats off to the past, coats off to the future!" He was sure that the next Hartlepool President would refer to that couplet, and they hoped that he would be able to say that they had done so. No business these days could rest upon its laurels and look for automatic increases in sales. Sales had to be sought for, and fought for.

The President had referred to the possibilities of gas in industry. There were great possibilities, no doubt, but in some parts of the country there seemed to be apathy in this respect. It was said in some industrial areas that there were no possibilities for gas. If these people went out to look for possibilities, they would find them, but it was useless to expect industry to come to the Gas Industry. They could not make full industrial progress while they had the present statutory limitations in regard to the methods of charge.

This was one of the most pressing problems before the Gas Industry to-day. The industrial user of gas was carrying an unfair burden at the present time, and it was a burden that could not be alleviated by one fell swoop or by a stroke of the pen. It would have to be done gradually as and when opportunities occurred in each undertaking's area.

The President's Address was not long, but it covered many subjects. He had mentioned the question of various organizations which the Industry had. They could not do without these organizations. They spent a lot of time in connection with these, it was true, which might be devoted to other purposes, but then they got certain information and results from these organizations ready-made, as it were, and were saved a lot of trouble that way. On balance, they were better off with them. He agreed with the President that it was time that some demarcation of the various organizations was advisable. But the Industry had had to tackle its questions as they came along, and thus in certain cases work had fallen to the lot of one organization which should be done by another.

Mr. Bradshaw's remarks upon road tar were invaluable. Now was the time when British road tar should come into its own. Not only was it better, but it was cheaper, and its greater use would cut out foreign imports of tar and help employment in this country. Their President had given them food for both thought and action. As he had said, they could supply a good article, and it was up to them to strive and develop it. Let it not be said by any future President that they had not responded to the call of 1931, "Coats off to the Future!"

Mr. J. H. CURRY, Sunderland Gas Company, seconding the vote of thanks, said that the President's Address had been as pointed as it had been stimulating, and would prove a remedial contribution to their difficulties. It was astonishing to him to find that, in a gas and water undertaking such as Hartlepool, nearly 76 p.ct. of its revenue should come from gas.

The vote was carried heartily.

The PRESIDENT, replying, thanked them for their generous reception of his paper, and Mr. Ridley and Mr. Curry for their remarks. Since the preparation of the Address some four weeks ago, matters had changed somewhat. Then, they had had a yard full of coke. To-day, because of the sudden demand, he doubted if they had a ton available on the works. A Presidential Address, he thought, could follow two lines: Either a description of the writer's gas-works, or a general review. A predecessor in 1921, however, had described the works, and since then there had been no exceptional alterations.

After the meeting, the members were conveyed in motor coaches to the gas-works, where Mr. Bradshaw conducted them round the No. 1 Works and the No. 2 Works, and Mr. George Neil, Assistant Engineer, was guide to the Water Works Pumping Station. Mr. L. M. Weldon, Distribution Superintendent, showed the party around the Victoria Road Showrooms of the Company. Afternoon tea, served later at the Grand Hotel, concluded the proceedings.

NOTES ON PLANT AND PROCESSES

"High Peak" Gas Fires.

A selection of moderately priced yet tastefully designed gas fires expressing both dignity and charm is contained in the new season's catalogue of the "Magna" series of "High Peak" fires of Messrs. General Gas Appliances, Ltd., of Guide Bridge, Manchester. Whether for private residences or public buildings there is a gas fire in the "Magna" series to harmonize with either modern or "period" surroundings.

The "Magna" fire is made in three sizes for 14-in., 16-in., and 18-in. fire openings respectively. The removal of the fire bars permits it being fitted into position and all that is necessary is the gas connection. This model is supplied with the "General" silent burner with patented gas adjuster giving a wide range of adjustment and fitted with the new "Gen-Ray" curved radiants. A sheet iron plate is fitted to the back of the fire, cut to shape to make a neat fitting to the brick back.

Particulars and illustrations, in colour, are contained in the catalogue of the different fires in the series, making a very attractive range.

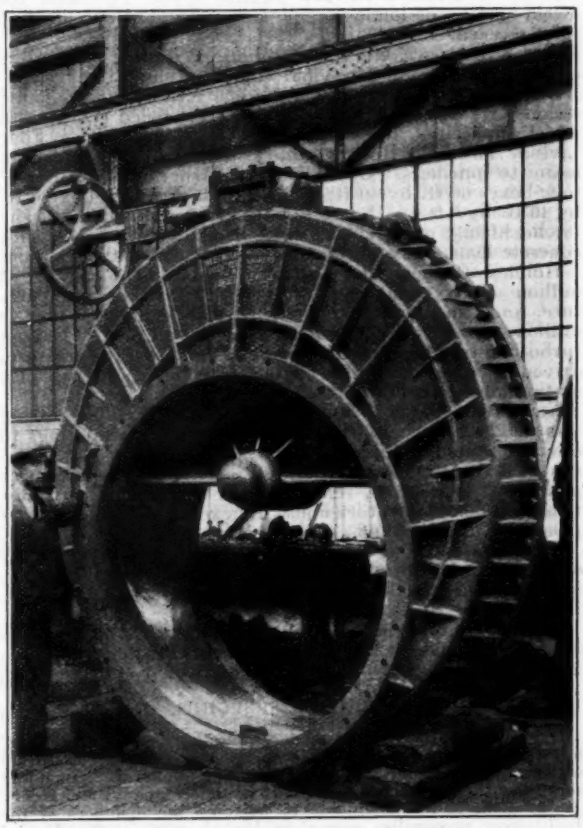
Details are also included of the "Nonsteam" luminous gas radiator, which is plain in design, yet simple, automatic, efficient, and attractive. The plain design of this appliance, it being free from ornamentations and dust pockets, ensures absolute cleanliness. There is a clear floor space under the loops for sweeping and dusting.

Mammoth Gas Valve.

We publish a photograph of a 72-in. bore gas valve, one of a batch being supplied to a large London gas-works by the patentees and makers, Messrs. Westwood & Wrights, Ltd., of Brierley Hill, Staffs. This is the largest gas valve which has been made in this country, being 9 ft. 7½ in. outside diameter, and weighing approximately 8 tons.

The general design follows the firm's well-known patent gas valve, made in sizes from 2-in. upwards, with an externally oiled face, the faces of valve and seating being permanently engaged, thus eliminating exposure to corrosive elements.

The circular valve face is revolved by a strong worm carried on thrust bearings, running in grease, and when in closed position engages wedges on the valve body to force on to its seating. Despite its great size, and attributable only to its unique design, this valve can be easily hand operated by two men, thus obviating electrical or hydraulic apparatus. The centre spindle and spring are enclosed in a permanent oil bath, and thus no steel portion of the valve comes actually in contact with the gas.



"Largest Gas Valve," by Westwood and Wrights, Ltd.

British labour and British material only were used in the manufacture. This achievement is a direct pointer to the manner in which the Gas Industry is tackling the needs of the moment, and speaks well for its future development.

Manchester District Institution of Gas Engineers

An Ordinary General Meeting of the Manchester District Institution of Gas Engineers was held on Friday, Oct. 9, at the new Gas-Works, Lostock, Preston. There was a large attendance of members, who, during the morning, were taken in parties through the works and inspected the plant. They were received by Mr. Walter Davies, a Director of the Company, and by Mr. S. Tagg, the Engineer and Manager. The members were subsequently entertained at luncheon.

Preston Gas Company's New Works.

In the morning a visit was paid to the new Lostock Hall Works of the Preston Gas Company. These occupy a site of 32 acres three miles south of Preston, and are linked by extensive sidings direct with the main L.M. & S. line. The original scheme was for 2 million c.ft. a day; but this was extended to five millions, advantage being taken of the Development (Loan Guarantees and Grants) Act, 1929.

Coal Handling Plant.—By Peckett locomotive to Whitehall rotary tippler to breaker pit. Surplus can be reclaimed by grab and stored by radial arm transporter. Four-roll breaker, 70 tons per hour capacity. Duplicate elevators to drag bar conveyor full length of retort benches. Storage hoppers of 60 hours' capacity.

Retort Benches.—Ten settings of eight 4-ton vertical retorts by Messrs. Drakes, Ltd. Each retort 49 in. by 21 in. oval at bottom, 36 in. by 12 in. at top, and 25 ft. long overall. Hanging bar grate producers, one to each setting.

Boilers.—Two Spencer Bonecourt waste-heat and two Lancashire.

Coke Handling.—Extracting gear, driven by 10 B.H.P. steam engines, delivers into steel skips. These are transported by telpher to concrete storage hoppers 96 ft. long, 32 ft. wide, and 16 ft. deep, divided longitudinally into two compartments. Breeze hopper to side, surmounted by receiving hopper and coke screens. Reciprocating feeder to screens of Drake's cascade jigging type. Provision for direct-loading of lorries or bagging. Telpher extended to storage yard.

Gas Treatment, &c.—Atmospheric C.I. pipe condensers in two sections for fractional condensation. Two Bryan-Donkin exhausters, capacity 125,000 c.ft. each. Exhaust steam for steaming retorts. Two water-cooled condensers; water circulated by pump from gasholder tank. Four Livesey and two Holmes rotary washers. Steam coil in main to purifiers. Broadhead Constructions' purifiers—four boxes 60 ft. by 40 ft. by 6 ft. and one catch box 30 ft. by 40 ft. by 6 ft., with two tiers of grids. Travelling crane for lid lifting; oxide shed 270 ft. long by 52 ft. wide, with concrete floor. Livesey washer for naphthalene extraction.

Holmes Connersville positive displacement meter, 5 million a day capacity, with pressure, volume, temperature, and time recorder. Four-lift spiral-guided holder, 3 million capacity, by Clayton, Son, & Co., Ltd. Rateau turbo booster, 100,000 c.ft. per hour against 8 in. pressure, driven by National gas engine. 30 in. counterbalance station governor; hand water loaded.

Electrical Plant.—Three steam driven D.C. generating sets of 125 kw. each. Engines fitted with special rings to obviate cylinder lubrication. Exhaust steam to atmosphere or heating service. Seven panel switchboard; three panels for generators, remainder for feeder circuits. Distribution board in retort house annexe connected to feeder panels by underground cables.

Tar and Liquor.—Underground wells, each 60 ft. by 60 ft. by 12 ft. 6 in., reinforced concrete bottom and roof, brick in cement walls. Elevated cylindrical tanks for loading to rail or road tank wagons.

Mains.—Retort bench to exhausters 2 ft. 6 in.; exhausters to holder 2 ft. Trunk main to Preston: 30 in. to 24 in. to 18 in.

LUNCHEON SPEECHES.

Mr. Walter Davies presided at the luncheon proceedings, and proposed the toast of "The Manchester District Institution of Gas Engineers and the Gas Industry in general." In doing so he mentioned that the Chairman of the Company, Mr. Henry Astley Bell, had been unable to welcome the members of the Institution personally, owing to his absence in the United States. It might be of interest to those present to learn that less than three years previously the site upon which the works now stood was an open field. Gas production had been commenced about six weeks previously. Probably they would all agree with him when he stated that the general lay-out and construction of the works reflected the greatest possible credit upon Mr. Tagg, the Engineer of the Company. There were still certain details to be completed, such as houses for the accommodation of the various foremen, &c., and when the works were entirely finished the approximate cost would be £300,000. The fact that the Board were prepared to invest that sum of money in the undertaking might be taken as good evidence of their faith that the Gas Industry was not yet down and out, in spite of the circumstances that for several years past there had been a good deal of boosting by Government Commissions and Government Officials and municipalities all over the country regarding their great opponent, electricity. He could not pledge himself as to what the views of his fellow-members on the Board were, but his own view was that there existed a consciousness which was growing stronger every year that the best brains in the Industry must be devoted to research and to scientific inquiry into the methods of production, distribution, and use of gas. If this was done, then he was quite satisfied that the Gas Industry would have a very long and prosperous future before it. [Applause.] The members of the Manchester District Institution of Gas Engineers possessed the necessary technical knowledge to see that that was done, and he, like all Directors of gas undertakings, looked to them to do it.

Research and Scientific Inquiry.

Col. W. M. Carr (Stretford), the President of the Institution, responded to the toast. After speaking in high terms of praise concerning the efficient manner in which the lay-out and construction of the works had been accomplished, he stated that it was a further proof of the fact that Mr. Tagg was one of the foremost and most progressive engineers in the country. [Applause.] The members of the Institution had visited Preston some ten years previously when Mr. Tagg was its President, and many of them well remembered the extremely cordial reception they received upon that occasion. Preston was blessed not only with one of the foremost engineers in the Gas Industry, but also with some of the foremost Directors, whose faith in the great future possibilities of gas merited the fullest admiration. It was one thing for engineers, who were in close touch with their work every day, to have that faith; but sometimes it was not easy, owing to the boosting of electricity, to get the members of Committees and Directors to see eye to eye with them.

As the Chairman had rightly mentioned, the future of the Gas Industry largely depended upon the assiduity with which methods of research and scientific inquiry were maintained. In the past, possibly, gas business had been obtained somewhat easily, and research and scientific inquiry, particularly in so far as they were directed to the use of gas, had been somewhat neglected. Personally, he was of opinion that research work on the manufacturing side had been good. It was now necessary that greater attention should be devoted to the various applications of gas. One important point was to be able to demonstrate to the manufacturer how he could use gas to his pecuniary advantage. Some of them had done some propaganda work in this direction, and what he had personally done in that way had convinced him that, quite apart from the large field of domestic heating and cooking, and in a good many instances, lighting, possibly the greatest field in the industrial north lay in the uses of gas in industry. Some manufacturers had objected to the use of gas on the ground that it was too costly. Therefore, more earnest attempts must be made to understand the difficulties of manufacturing problems, and to establish ways and means of demonstrating the economic advantages of the use of gas for the production of commodities. The fact was that gas producers generally were not yet sufficiently convinced of the great vista of possibilities which lay before them. Too often they told one another that such and such a field of industry was not suitable for the use of gas, because it was too expensive. Yet the Industry was not, at present, fully conscious of the great strength it possessed. It was really amazing to learn at what price gas could be sold in order to displace the use of oil, and, in many instances, of solid fuel, to the economic advantage of the manufacturer.

He hoped sincerely that Lancashire and the North generally would soon be in the position of having an industrial and scientific research station directed by the best brains which could be obtained for the purpose of developing further avenues for the use of gas. If progress was made quickly in regard to this matter, then they would all be ready to cope with the revival in trade which everyone was hoping would happen soon. The time to act was when trade conditions were bad, so that when the improvement occurred the industrialist would be ready to buy their product.

The Preston Gas Company.

Mr. R. E. Gibson (Liverpool) proposed the toast of "The Preston Gas Company." He said that some forty years ago they used to think of purifiers in connection with Preston. Mr. Henry Green, who was then the Preston Engineer, was the first to introduce a new method of constructing purifiers. He adopted the use of rubber joints in conjunction with large boxes, there being a number of lids to one box, in place of the old water-lute arrangement. Probably Mr. Green did not claim

to be the introducer of the rubber joint, but he certainly adopted a method in the construction of purifiers which had become standard practice in this country ever since. The Preston Gas Company had a long and worthy history of steady progress, and particularly so during the term of office of Mr. Tagg. The output of gas had practically doubled under his direction, and the number of consumers had increased by about 50 p.ct., with the inevitable and praiseworthy result that it had become necessary to provide new and larger plant. The keynote of the direction of the Preston Gas-Works had been efficiency with economy, and in the present installation the Company had obtained very good value for their money. The Company was one of the oldest, dating back to 1815.

Mr. S. TAGG responded to the toast, on behalf of the Preston Gas Company and its Directors. In doing so, he wished to express his acknowledgment of the assistance of all those who had contributed to the construction and erection of the works. He wished, also, to tender his acknowledgment of appreciation to the members of his Board for the confidence they had reposed in him. Without their unfailing and unvaried support nothing could have been achieved. He was very much cheered to learn from Mr. Davies how great was his belief in the future prosperity of the Industry. For the past seven years, apart from the present works, the Company had spent £1000 every week on the extension and renewal of mains, services, meters, and the provision of appliances. During the past five years consumers in the Preston District had invested over £125,000 of their capital in the provision of appliances for the consumption of gas.

He must acknowledge, also, the assistance which had been so ably and so willingly rendered to him by all the members of his staff. It would be invidious to refer to them all, but he did desire to acknowledge, particularly, the services of Mr. Langley, the Chief Draughtsman, and of the Assistant Engineer, Mr. Heald. Great assistance had also been rendered by the contractors in carrying out the work, Messrs. Drakes, Ltd., and their Chief Draughtsman, and by the local contractor, Mr. Croft, who was a man of extraordinarily wide experience as a civil engineering contractor. Mr. Croft's experience had been of the utmost benefit to the Company.

ORDINARY GENERAL MEETING.

After a short adjournment, the Ordinary General Meeting of the Institution was held, at which Col. CARR presided.

The members stood in token of silent respect for the memory of the following members: Mr. W. S. Haddock, Warrington (Member 1885, President 1898, Hon. Member 1925); Mr. H. Pickford, Farnworth (Member 1905); Mr. J. Smith, Colwyn Bay (Member 1903); Mr. W. Whatmough, Southport (Member 1890, President 1917).

The PRESIDENT said that it gave them all particular pleasure to have the opportunity of welcoming the Senior Past-President, Mr. Ball, of Rochdale.

PRESENTATION OF EXAMINATION CERTIFICATES.

The PRESIDENT, before presenting examination certificates to 26 successful candidates, referred to the fact that, in the 1931 examinations of the Institution, out of six external candidates receiving the Diploma of Gas Engineering three were from the area in which they were meeting. He wished to congratulate Mr. H. Johnson, of Blackpool, who submitted a thesis on "Modern Retort Materials and Carbonization" for which he was awarded a First Class Diploma. Mr. W. P. Smith, of Bolton, had also received a Diploma for his thesis on "Experiments on the Substitution of Water Gas for Steam in the Quenching of Coke in Vertical Retorts and its Effect upon Carbonization." Mr. Smith, the President stated, was the son of the immediate Past-President, and had received a First Class Diploma. Their congratulations must also be extended to Mr. B. Thorpe, of Huddersfield, for his thesis on "The Study of the Problem of Naphthalene Removal," for which he gained a Second Class Diploma.

Examination Certificates were then presented.

The PRESIDENT announced that 10 out of the 26 Certificates presented were to students from the Huddersfield Technical College.

TITLE OF THE INSTITUTION.

The PRESIDENT mentioned that the next item upon the agenda was to receive the Committee's recommendation that the title of the Institution be altered to "The Lancashire, Yorkshire, and District Association of Gas Engineers." The matter had been discussed very briefly when the Committee's recommendation was brought before the last meeting, and the desire had been expressed that the question of any change of name should be deferred for further consideration and discussion at the present meeting. He, personally, did not desire a change. At the same time, it must be appreciated that it was the wish of many members that the name should be extended to cover the scope of the Institution as it existed at the present time. Therefore, he felt that he ought not to press his own objections, and accordingly he supported the recommendation of the Committee for the change of name to the Lancashire, Yorkshire, and District Association of Gas Engineers.

Mr. R. E. GIBSON (Liverpool) said he would prefer to see the name altered to "North-Western District Association."

The PRESIDENT said that the Committee had considered the question of adopting the title "North-Western." Several members of the Committee pointed out, however, that members were drawn from even the East Riding of Yorkshire. It was felt, for that reason, that the title "North-Western" did not cover the area of operation of the Institution.

Mr. C. S. SHAPLEY (Leeds), speaking as a member of the Committee which had discussed the matter, stated that the Committee was unanimous there should be a change of name. He hoped that the name would go forward as suggested by the Committee.

Mr. G. S. FRITH (Runcorn) proposed the substitution of the word "Association" instead of "Institution." He did not like the title "Lancashire, Yorkshire, and District Association of Gas Engineers." It was a most unwieldy one.

Mr. S. CARTER (Liverpool) seconded the amendment.

Mr. A. L. JENNINGS (Spenborough) supported the recommendation of the Committee. As a large number of members were drawn from the Yorkshire District, as well as other districts besides Manchester, he was of opinion that the name selected was very appropriate.

Mr. CHARLES WOOD (Bradford) supported the recommendation of the Committee. The term "North-Western" meant very little to him personally.

Mr. J. T. HAYNES (Bolton) felt that the old title of "Manchester and District" carried associations which a large number of the members would like to see continued. Therefore, he supported the amendment that the title be "The Manchester District Association of Gas Engineers."

The amendment proposed by Mr. Frith was then put to the vote and carried by 30 votes to 24.

Mr. W. J. SMITH (Bolton) said that the matter affected a large percentage of the members, and rather than force any position upon them he would let the matter remain in abeyance until some further effort could be made to formulate a title which would be more satisfactory to everyone.

The PRESIDENT cordially agreed with the remarks made by Mr. Smith. It would be extremely undesirable that any course of action should be taken in such a matter which was not acceptable to the whole of the members. It had been hoped, in view of the fact that the matter had been discussed at the September meeting, that unanimity would have been secured, but apparently they were as far away from that consummation as ever.

The PRESIDENT said it was now suggested that the matter be referred back to the Committee, who would send out a circular letter containing the suggestions put forward at the meeting. All the members would be asked for an expression of opinion as to which of the three names they would prefer, and the question would again come up for consideration at the next meeting of the organization as a whole.

Mr. SMITH: And then put to the vote?

The PRESIDENT: Yes.

Mr. CHARLES WOOD suggested that the whole matter should remain as it was, and that the old name should be adhered to for the present.

The PRESIDENT asked the members not to lose sight of the fact that the Chartered Institution of Gas Engineers had requested them to make the change. The matter had been under consideration now for nearly two years, and little or no advance had been made.

Mr. GIBSON thought that the meeting could very well agree to change the word "Institution" to "Association," and leave the other matter over for further consideration. He moved that.

Mr. CHARLES WOOD seconded the proposition.

Mr. SHAPLEY supported it.

The PRESIDENT then put the motion to the meeting, and it was carried unanimously.

DILUTION OF STRAIGHT COAL GAS.

The PRESIDENT said the next business was the adjourned discussion upon the short papers dealing with "Methods of Dilution of Straight Coal Gas," which were presented at the previous meeting. Unfortunately, Mr. J. E. Blundell and Mr. G. Dixon were not able to attend on this occasion. Mr. Dixon would soon be leaving the district and transfer his activities to Nottingham. All the members would congratulate him on getting that important appointment. [Applause.]

Mr. R. G. SHADBOLT (Birmingham) said that 35 years ago he experimented with the idea of utilizing flue gases by passing them through a fuel bed, re-converting the carbonic acid to carbon monoxide, and ascertaining its utility, economy, and practicability in use. The first set of experiments were conducted with three direct-fired settings, half the waste gas from

one setting being passed through No. 2, and the remaining half through No. 3. Experience proved that it was quite practicable and successful up to a point. That point was that one fuel bed could not deal continuously and successfully with half the flue gases from another one; so that it really was choked and smothered out. Sufficient experience was gained to try this out at another works in conjunction with regenerative settings, and distinct advances were made, but still they never got far beyond compelling No. 2 and No. 3 to convert half the gas from No. 1 setting. During those experiments he found that Siemens had anticipated him, and the Siemens method was in use at Kilmarnock and Wallasey. It was very simple—using a steam jet and exhausting the quantity of waste or flue gases from the chimney flue and adding the necessary quantity of steam, primary air, and secondary air. That method was used at Kilmarnock and Wallasey for years, but he believed it had been discarded and replaced by ordinary regenerator systems. He mentioned this to show that personally he was studying the action of the formation, recuperation, and so on of flue and producer gases at that early stage.

From then to about 1902 he continued to experiment in the use of producer gas in various ways; his experiments and trials convincing him that producer gas was utilizable for many purposes. In the course of time, through the advent of the incandescent burner and various other matters, it was driven home to him that the gases sent out were much too heavy to induce a sufficient flow of air, and therefore soot was deposited on mantles, on gas cookers, in gas engine cylinders, and so on. So he set to work to see to what extent he could use producer gas as a diluent to assist in bringing about complete combustion, or, in other words, slightly less aeration requirements. Those experiments were successful to an extent. From about 1902 all the gas at the undertaking he was then controlling was diluted by means of the best producer gas they could secure. First of all, from an ordinary producer of the Chester type, with the producer projecting some 3 ft. or so. Next by forming a curtain wall, and so making a small hopper to ensure a regular and constant thickness of fuel. The next step was, owing to certain irregularities in the composition, despite all precautions, by this means to pass the gas into a retort charged with coal instead of coke, using it as a reducing fuel bed, and so obtaining a producer gas with a practically fixed constant of carbon monoxide and likewise a minimum fixed constant of carbonic acid. This was successful, and worked for some considerable time. It met the cases of under-aeration previously experienced, and it led gradually to the reduction of what was in those days the illuminating candle power standard.

About 1920 a total gasification plant was adopted because it gave a much greater range of flexibility than a simple producer. One could regulate the proportions of the mixtures by valves and by cocks, and get the requisite amount of flexibility over the four seasons of the year. Such a plant enabled coal gas retorts to be worked with great regularity and at the highest efficiency. Experiments had been made in the meantime with the outside producer, and they had that as an additional string to their bow. So they rang the changes, using a fixed number of retorts the year round and changing the proportions of the diluent gas in accordance with the requirements. That was to say, if a smaller volume of diluent was required, a poorer quality of gas was used; if a larger volume, then the better, or total gasification, gas was used.

In the course of the papers points were raised with regard to the variations in specific gravity which were likely to accrue from the utilization of such diluents as producer gas. Without attempting to go into details, he would refer the members to the article on "Flexible Gas Production" which he contributed to the "Gas Journal" in August, 1926. This showed quite clearly that ringing the changes and utilizing the flexibility of this arrangement to the utmost over the whole year of Birmingham's supply, working constantly with one set number of retorts and working the coal gas plant to its most efficient capacity, the variations to meet all the changes in seasonal requirements over two or three years were 3 p.ct. in the calorific value of the gas and a maximum of 10 p.ct. with regard to the specific gravity. Those points perhaps had some bearing upon what had been said with regard to specific gravity. Specific gravity was a consequential effect. The calorific value simply varied according to the use of the diluent. During the entire period that method had been in use up to the present time the calorific value had come down from 550 B.Th.U. to the abnormal minimum in special circumstances of 350 B.Th.U. on the entire output.

With regard to distribution under those conditions, when utilizing a larger proportion of producer gas there was a tendency for naphthalene to be deposited. Of course, dilution, like aeration of flame mixtures, could only be effective where a margin for such dilution existed. If an undertaking was already making gas of the quality required, dilution did not affect it, but if normally the undertaking was making a gas which was too heavy or too rich, and not aerated easily enough for the purposes to which it was put, they could have a margin.

Mr. W. Buckley (Droylsden) said that Mr. Carr diluted only about 5 p.ct., and seemed to be spending rather a lot of money for such a small result. The cost of this producer gas was given as 1·86d. per therm. From the analysis it appeared he did not put into his gas an undue quantity of inerts.

The cost of Mr. Holton's gas was only 1d. per therm, even taking into account interest and sinking fund charges; so apparently the Trefois producer was a much better piece of apparatus than the ordinary built-in producer.

Mr. Dixon, in his remarks, said he had difficulty in steaming. That statement he (Mr. Buckley) could not quite associate with the result given in the gas analysis. On his straight coal gas Mr. Dixon had 7·7 p.ct. of carbon monoxide, and on his steamed gas he had 14·7 p.ct. That meant something like 13 or 14 p.ct. steaming. He (Mr. Buckley) was basing that on work with ordinary verticals.

The cost of Mr. Clegg's water gas was about 1·23d. per therm. Unfortunately he had in his gas quite 20 p.ct. of inerts. He did mention that it was advisable to put into the gas a certain amount of carbon monoxide, because that was a good thing to have in a combustible gas—he mentioned the heat of that gas, and the effect on the flame—but he overlooked the fact that he was adding to his gas an inert which had a very high specific heat. At 1000° carbon dioxide had a specific heat of 0·502, nitrogen 0·321. Those data were taken from Spiers' Technical Data on Fuel. At 100° the CO_2 was 0·411, the nitrogen 0·311. It seemed to him the method which would give the highest efficiency was that method which put in the gas a minimum quantity of inert in the form of carbon dioxide or nitrogen. He was afraid the fact was overlooked that for certain purposes for which gas was used the flame temperature was a very important factor. Even in incandescent lighting flame temperature was a considerable factor in the production of efficiency or otherwise. Now if into a gas inert was put which had this high specific heat, a definite and large quantity of the inherent heat produced by combustion of the combustible must be utilized in raising the temperature of the inert to the temperature of the flame; therefore that must entail a considerable loss of efficiency. For that reason he supported Mr. Blundell in his argument for production of a diluent in a continuous vertical retort, where one had complete control over the heating of the retort and over the quantity of steam put in, and absolute control of the gas produced.

The idea was very common that when steaming in vertical retorts, they must of necessity get weak liquor. This was not so. If weak liquor was got from vertical retorts after steaming, it meant that there was being added a large excess of steam which was not being converted into carbon monoxide and hydrogen, or the temperature of the retort was not sufficiently high to convert into water gas the steam which was being put through the retort. He had had some little experience at Droylsden of steaming in verticals, and over a year the average of the ammoniacal liquor probably ran to about 9 oz. strength. It had been higher than that. So, although they had 18,000 c.ft. to the ton, which meant a considerable amount of steaming, the liquor was not weak. He would like, once for all, to kill the idea that when steaming in vertical retorts they would necessarily get weak liquor. If they did it was their own fault.

Benzole Extraction.

Mr. C. R. Ingham (Brighouse), in a written contribution, stated that if the purpose for which dilution of town gas took place was mere reduction in calorific value from, for example, 540 B.Th.U. gas to 500 B.Th.U. gas, the extraction of benzole was a particularly suitable method, but it was not mentioned in the papers. A more or less complete removal of benzole would reduce the calorific value by about 30 B.Th.U. per c.ft. The duty on imported motor spirit made the production of benzole at gas-works a proposition worthy of careful consideration, particularly so from a national standpoint during the present financial crisis, when home produced articles should be preferred to those of foreign origin and exchange rates were favourable.

If the purpose of the dilution was regulation of calorific value, the various methods mentioned in the papers were worthy of close attention. Of course it was possible to distribute straight coal gas of regular calorific value provided good mixing could be obtained in the holders. His own practice was to distribute straight coal gas of a calorific value of 500 B.Th.U. per c.ft., and no particular difficulty was encountered in maintaining this value within the limits of 490-510. It might be said that this gas was not straight coal gas but coal gas degraded by overpulling. He freely admitted this. But what were the evils of overpulling to this extent? Were they not taking it too much for granted that "overpulling" was a most uneconomical practice? It was frequently stated that a reduced thermal yield was obtained, together with trouble with stopped pipes and pitchy deposits. In his own case they obtained 73-74 therms per ton of coal with a coke yield of 10½ cwt., excluding the coke used on boilers.

No trouble through stopped pipes had been encountered during the last few years. He did not think they were losing much in the way of thermal yield by the very gentle overpulling they were practising.

The one point on which he was not certain was whether the effect on the life of the settings might be detrimental. Owing to the fact that the only settings he had renewed since working in this manner were started up very quickly and forced during the coal stoppage of 1926, any figures he could give would be misleading. However, he felt there was a good deal to be said in the medium sized works for this simple straightforward method of producing gas of reasonably high calorific value.

Mr. Ingham added that the plant at Brighouse was machine-charged horizontals with anti-dips. The vacuum was recorded to within a fiftieth of an inch of water, and it was claimed they were not pulling blindly on the settings, but were working the vacuum in accordance with the quality recorded with a Sigma calorimeter placed alongside the retort house governor control, which had been transferred to floor level.

The Authors' Replies.

Mr. J. H. Clegg said he was very interested to see that Mr. Shadbolt had practised the dilution of horizontal retort gas by means of flue gas, and that he had endeavoured to convert

his CO_2 by passing the flue gas through a producer. He did not quite see the necessity of that. If the dilution was a low figure, and he thought it would be quite low in those days to which Mr. Shadbolt was referring, the final CO_2 would not be excessive. From the analysis which he gave in his paper, it would be seen their final gas contained only 5 p.ct. CO_2, which in his opinion was not excessive. There was also the point of keeping the producer alive. In these days when flue gas was used for the production of steam from waste heat, a very low oxygen content was necessary, and the oxygen in that gas was scarcely sufficient to keep the producer alive without a great deal of attention. There was a limit to the amount of dilution which could take place with flue gas.

Mr. Buckley mentioned that the low cost with the Trefois producer was entirely in its favour, and indicated that it was the best method of dilution. But it must be remembered that most of the horizontal retort installations in this country were small and were owned by undertakings that could not afford to install the Trefois producer. Therefore other means had been adopted for dilution, some of which could not bear the light of investigation. He could imagine there were in this area a large number whose methods of dilution produced extraordinary results.

Mr. Buckley deprecated the percentage of inerts that they had in their gas. He was not attempting to defend that. Particularly would he deprecate a high CO_2 content. Carbon dioxide would considerably reduce the flame temperature. But nitrogen had to be admitted, either in the gas itself or at the point of combustion, and in any case had to be heated to the desired flame temperature.

One of his objections to heavy steaming was the production of a high hydrogen content. In investigating industrial uses for gas he found a high hydrogen content was a distinct disadvantage in insulated vessels, where one often got condensation of the water between the insulation and the steel case. In certain cases exterior insulation was provided to prevent the condensation of this excessive moisture, to allow it to pass away with the waste gas.

At the meeting of the Institution of Gas Engineers in Leeds, it was emphasized that it was well worth consideration in many undertakings to dilute the gas by the removal of benzole, particularly where the cost of the gas into the holder was very low. This was a favourable moment in view of the large taxes placed upon petrol. Many undertakings could partially dilute and get a better price per therm, with other advantages.

Mr. HOLTON said all of them who had studied dilution acknowledged their debt to Mr. Shadbolt. One of the first articles that he himself looked at dealt with Mr. Shadbolt's work at Grantham. He understood Mr. Shadbolt to say that in his dilution there was never a greater variation in specific gravity than 10 p.ct. The tables that he himself took some time in getting out rather emphasized the fact that 10 p.ct. variation in specific gravity was too much if it could be avoided. In addition to the lower calorific value they were getting loss through the nozzle, so the 10 p.ct. became a very much higher figure on the actual efficiency to the consumer, which was the point he particularly wanted to stress in the paper. Mr. Buckley had advocated very strongly dilution as practised in vertical retorts, but one must not lose sight of the fact that dilution as practised in vertical retorts meant a very great loss in the coke available for sale. In certain states of the coke market the expense of the diluent became much higher than Mr. Carr's figure or his own.

The PRESIDENT said they appreciated very much the value of Mr. Shadbolt's early work in this direction at Grantham. It was well known to all of them. Mr. Shadbolt mentioned passing the flue gas through a retort and converting the CO_2 content. Of course in those days he was working at a very great disadvantage with a small grate area and with direct firing, and the CO_2 content was excessively high. With a small grate area the tendency was to get hot pockets and excessive production of CO_2; with a large grate area that did not arise to anything like the same extent. Their experience at Stretford was that the CO_2 ought not to vary very much from 5 to 6 p.ct.

Provided the producer was of suitable size and the quantity of diluent gas required was not very great, the cheapest method was to take the producer gas from the built-in setting. That was so particularly in works of a certain size. He was not going to argue that in a very big plant it would be the most desirable method. At Stretford they were working two eight-hour shifts, four-hour breaks; therefore the quantity of diluent gas required was smaller than it would be if they were working continuously. The figures he gave in the paper showed under the particular conditions a diluent of only 5 p.ct., but the average quantity of diluent they put in was between 10 and 12 p.ct. to get their 500 gas. His cost had to be calculated back, and he calculated on a very low efficiency—he thought it was a lower efficiency than he actually got on his built-in producer. He had given 11 lbs. of coke per 1000 c.ft. of producer gas. This was a low efficiency, approximately 60 p.ct. With the Siemens type of producer they were getting a higher efficiency than that.

There was much to be said for each of these processes, and no one could afford to be dogmatic. Where difficulty was experienced in disposing of the coke there was a good deal to be said for the process which would give the highest thermal yield and the least coke, but if the undertaking was in an area where the coke could be disposed of, a good deal could be said for the process that would give the maximum coke yield.

OXIDE OF IRON PURIFICATION OF COAL GAS.

The PRESIDENT said that Mr. R. H. Clayton, Mr. H. E. Williams, and Mr. H. B. Avery had submitted a joint paper on "Oxide of Iron Purification of Coal Gas." It gave an account of the research which Mr. Clayton had carried out with Mr. Williams and Mr. Avery during the last two or three years. It would be a very valuable contribution to the Proceedings.

Mr. CLAYTON gave a summary of the paper, and a series of lantern slides was shown and explained by Mr. Avery.

The PRESIDENT said the paper was a most excellent and up-to-date treatise on the best practice in oxide purification, and would be much appreciated by the Industry. Time did not permit them to discuss it now. It seemed to him they had to consider in many instances the desirability of going in for very much larger oxide content by means of larger boxes, with a consequent saving of labour and space. The lantern slides which showed what was being done in the Ruhr were a good indication of the future line of development. He hoped they would not be forced to turn to wet methods of purification, which in the majority of cases were more difficult to control.

ELECTION OF OFFICERS.

The President announced the results of the voting. The President for the ensuing year would be Mr. C. W. Ward, of Wakefield.

Mr. WARD: I thank you very much for this great honour. I am conscious of the responsibility which attaches to it, but I will do my best to fill the office worthily, and I am sure you will give me the help I need.

The other officers appointed were:

Senior Vice-President.—Mr. G. Dixon (Nottingham).

Junior Vice-President.—Mr. F. G. Shaw (Buxton).

Committee.—Mr. G. P. Mitchell (Blackburn); Mr. H. Singleton (Huddersfield); Mr. R. Webb (Leeds).

Auditors.—Mr. W. Hill (Stalybridge); Mr. F. Elliott (Leyland).

Secretary.—Mr. J. Bridge (Elland).

The proceedings concluded with a vote of thanks to the Preston Gas Company, to Messrs. Clayton, Williams, and Avery, and to the contributors of the papers on "Dilution of Straight Coal Gas."

Institution of Mechanical Engineers

In the Lord Mayor's Banqueting Room at the Guildhall, Portsmouth, there took place on Friday last, Oct. 9, the first Annual Dinner of the newly-constituted Southern Branch of the Institution of Mechanical Engineers. The Branch comprises all the members (about 500 in number) of the Institution resident in the counties of Dorset, Hampshire, and Sussex.

Engineer Vice-Admiral Sir George Goodwin, K.C.B., LL.D., as Chairman of the Branch, presided. He was supported by all the members of the Committee (with the exception of Mr. H. C. Head, Engineer of the Winchester Gas and Water Company, who was absent owing to indisposition), including Mr. Thomas Carmichael, Engineer to the Portsmouth Gas Company, and Mr. Walter T. Dunn, ex-Secretary of the Institution of Gas Engineers. Among others present were Mr. J. R. H. Jacobs, Managing Director of the Southampton Gas Company, and the Engineer, Mr. S. G. Whitehead, B.Sc.

The toast of "The Southern Branch" was entrusted to Alderman F. G. Foster, J.P., Lord Mayor Elect of Portsmouth.

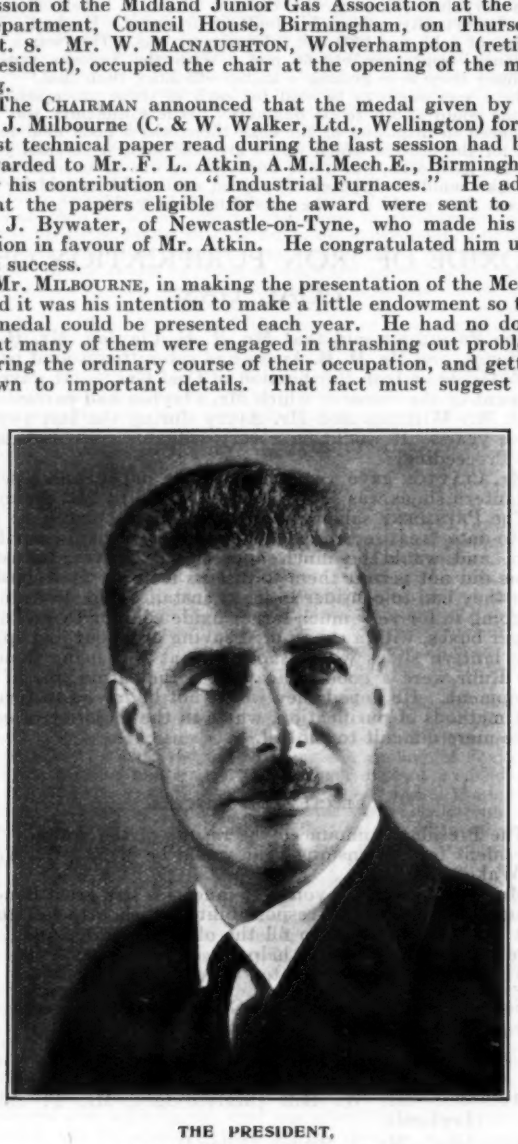
In the course of his reply the Chairman made special reference to the vitally important work carried out by the Gas Industry during the operations of the war, and paid tribute to the manner in which the members of the gas engineering profession had accomplished the tasks which had been set before them.

Midland Junior Gas Association

There was a large attendance at the opening of the session of the Midland Junior Gas Association at the Gas Department, Council House, Birmingham, on Thursday, Oct. 8. Mr. W. MACNAUGHTON, Wolverhampton (retiring President), occupied the chair at the opening of the meeting.

The CHAIRMAN announced that the medal given by Mr. R. J. Milbourne (C. & W. Walker, Ltd., Wellington) for the best technical paper read during the last session had been awarded to Mr. F. L. Atkin, A.M.I.Mech.E., Birmingham, for his contribution on "Industrial Furnaces." He added that the papers eligible for the award were sent to Mr. F. J. Bywater, of Newcastle-on-Tyne, who made his decision in favour of Mr. Atkin. He congratulated him upon his success.

Mr. MILBOURNE, in making the presentation of the Medal, said it was his intention to make a little endowment so that a medal could be presented each year. He had no doubt that many of them were engaged in thrashing out problems during the ordinary course of their occupation, and getting down to important details. That fact must suggest the



THE PRESIDENT.

WILLIAM LAWRENCE S. SPINKS.

Mr. Spinks was educated at Solihull Grammar School. He joined the staff of the City of Birmingham Gas Department in 1906, and in 1923 was appointed Commercial and Technical Assistant to the Chief Superintendent of the Fittings Department. He is a Past-President of the Midland District Gas Salesmen's Circle, a member of the Midland District Education Committee, and a teacher of Gas Supply at the Birmingham Central Technical College.

various problems which would be of interest to the Association. There were, of course, many problems—the technical education of the junior engineer and the education of the salesman and those of the distribution department. Such problems were of the utmost importance at the present time, when the Gas Industry had to contend with acute competition.

Mr. ATKIN acknowledged the gift.

The CHAIRMAN, having thanked the members for their support during the past session, introduced the new President, Mr. W. L. S. Spinks, of the Birmingham Gas Department, who, he said, had been a member of the Association since 1911. He had served on the Education Committee, and had rendered useful service in various directions to the Association and the Industry.

Amid applause, Mr. SPINKS then took the chair; and proposed a vote of thanks to Mr. Macnaughton for the efficient way in which he carried out the duties of President last year. He had shown tact and judgment, and his advice had been most valuable.

The resolution was seconded by Mr. A. R. MYHILL (Birmingham) and heartily approved.

Mr. F. A. C. Pykett (Coventry) becomes the Senior Vice-President, and Mr. S. K. Hawthorne (Birmingham) the Junior Vice-President.

PRESIDENTIAL ADDRESS

of W. L. S. SPINKS, City of Birmingham Gas Department.

[ABSTRACT.]

It has been stated that there is scarcely any commercial article which cannot be improved in some way and made more suitable to its purpose if its construction is carefully analyzed by a mind freed from tradition. Tradition puts the tap of a gas fire on the right hand side, although obviously the right hand of most persons lighting the fire is occupied in holding a taper or match.

I suggest that as juniors we must regard tradition with suspicion and cultivate an analytical mind. A certain amount of routine work falls to the lot of most juniors, and we may be judged by the way we set about it. It may be used as an excellent opportunity for mental loafing, repetition allowing us to obtain quite creditable results with a minimum of conscious thought, or we may keep an alert mind to discover what part our job occupies in the chain and whether the way the last man did it was the best of all possible ways. Almost any operation can be improved, and progress comes just as much by constant improvement of details as by revolutionary changes. It is always possible, therefore, to take an interest in routine work; but do not learn to love it, lest you join the great army of those who want a nice quiet little job without worry. There is, unfortunately, a large number of that kind of people about, and I am afraid the world is becoming an increasingly unsatisfactory place for them.

GAS MARKETING.

The changes in the Gas Industry during the twenty-three years of this Association's life have been far greater than all that took place in the seventy or eighty that preceded it, and no doubt the next five or six years will see changes yet greater. We shall see changes in manufacture, in distribution, but above all in gas marketing.

To meet these changes a new outlook is needed by many boards and committees. This question of marketing our product is not to be met just by putting on additional salesmen. Additional salesmen, properly trained, are necessary in the Industry, but unfortunately only a proportion of gas undertakings are in a position to benefit fully from them, because the organization behind their salesmen is incomplete. The actual salesmen are but the fringe of a network which must cover the whole policy and administration of the undertaking. The salesman needs behind him a works organized to produce cheap gas of uniform quality, a distribution system planned to meet all demands with a constant pressure. But he wants more than that. He wants his undertaking to have a real forward-looking policy towards its customers. And he wants yet more. He wants this policy to be translated into a belief, and every employee to be a true believer.

THE MINOR OFFICIAL AND GOODWILL.

It might be a revelation to many progressive boards and many up-to-date administrators could they really find out (fortunately for their peace of mind and the unemployment returns this is usually impossible) how often their best efforts to secure the goodwill of their customers are thwarted by the attitude of subordinates.

If an undertaking has 100,000 customers, 50,000 of them form their opinion of the Company not from the sentiments expressed in its advertisements, nor from the pronouncements of its board of directors, but from the conduct of its meter inspectors, an occasional fitter, or perhaps a counter clerk.

Now that the more or less haphazard technical classes of pre-war days have been replaced by well-organized courses of study, it behoves undertakings to consider carefully whether, as a result, their minor officials are not becoming less educated rather than better. As the goodwill of our customers is dependent very largely upon the actions and words of these minor officials, it will be very unfortunate if any scheme of education in the Industry has the effect, if only for a few years, of making it difficult for them to find a convenient method of improving, in an elementary

manner, their knowledge of their Industry and their undertaking.

I feel sure many administrators would be surprised to find how many of their employees would be very ready to attend in the evening lectures and demonstrations of a popular character, designed to give them an idea of the processes of gas manufacture and distribution, the history and aims of their own undertaking, and the problems it was facing.

I am a great believer in the value of employee support as an aid to success of a service policy, and if a company has an up-to-date policy it is worth while taking as much time and trouble getting that policy made known to, and believed by, its employees as is given to advertising it to the customers.

Legal and Creative Minds.

I admit there are difficulties in the way. I said a few minutes ago that there are many men with "routine" minds. These look upon regulations as heaven-sent blessings—a shield and buckler to be held up between their own peaceful enjoyment of life and the idiosyncrasies of the customer. To these any change, any development, is anathema. But apart from what I call the "routine" mind, which is after all mainly due to mental sluggishness, the staff of any undertaking is made up of persons each of whom may be said to possess either a legal or a creative mind; and whatever may be the avowed policy of an undertaking, its actual policy will be decided by whether the legal or the creative minds of its staff have the predominance. We cannot, of course, draw a rigid line, but the fact remains that each one of us has a natural tendency when confronted by a problem, either to look back for precedents on which to base our action, or to stand aside, as it were, and sum up the facts, and then to decide what to do to achieve the desired result. Such minds will take pleasure in analyzing a policy and in interpreting its spirit in their actions. Whenever we have a statesmanlike policy, combined with a predominance of such creative minds in the staff, we shall have an undertaking that will make steady progress.

It must not be thought that the legal mind is incapable of action and decision. It is rather that it looks at every problem in the light of the past, and that any decision is tinged by the memory of past acts. It is willing to spend more time comparing present circumstances with past events, than upon speculating upon the effect of present action upon future events. Changes of all kinds are so much more rapid now than heretofore that this legal mind may do a great deal of harm. It must be remembered that no two groups of circumstances are precisely the same, and no one solution can exactly fit two situations, even though they may be similar. It would be well for administrators now and then to review their staff and find whether the advancement of the Company is not being retarded by too great a reverence for tradition.

I ask any one of you when you get back to-morrow, to examine a copy of your company's gas bill, and ask yourself "Is this the invoice that Gordon Selfridge would send out if he acquired a gas-works?"

Perhaps it is our own fault if our customers class their gas accounts with their rates and income-tax demands. We may send out our accounts on bills that have a nasty family resemblance to them. Should we be really losing much if we omitted all those explanations of how to read a meter, and those warnings as to what to do in case of escapes. After all, 50 p.ct. of our customers have automatic meters, and they manage to struggle along without these quarterly reminders which, to my mind, make a horrid document out of what should be an ordinary business account. Railway companies are the same. They must print on their tickets all that jolly information about "Issued subject to the conditions and regulations in the Company's time tables, books, bills, notices, &c." Does it really safeguard them from many claims? Would it not be better to put "When you use this ticket you are travelling on the finest permanent way in the world" or something of that kind?

Is it not possible that our gas bills are an example of the predominance of the legal mind, and of our hesitancy to allow the creative mind full sway?

Census Schemes Only a Means to an End.

One of the aids to gas sales, of which much has been written and spoken recently, is what is usually known as the general canvass or census scheme. The primary object of this is to secure a record of all appliances fixed on the district, and if possible to contract for their periodical inspection and maintenance.

Here we have an excellent example of the diverse effect of legal and creative minds. Your legal mind will quite efficiently organize such a canvass, evolve a card system above reproach, and take steps to keep the information up-to-date; but unless the creative mind is there to use the information for increasing sales, or as a basis for special sales campaigns, much of the money spent will be wasted, and the useful value of the information will be very much on the same plane as that in a directory.

Sales Organization Calls for First-class Brains.

I believe that the sales policy of an undertaking presents problems that cannot be adequately solved by second-class brains, yet we have to confess that the Industry as a whole seems unprepared to offer remuneration that will attract first-class men to its sales side. The Gas Industry must remember that when it comes to marketing its product, it is in open competition, so far as obtaining or retaining its staff is concerned, with other commercial concerns. I am afraid that at the moment young men of good education and ability, who enter commerce with the intention of eventually securing positions as sales managers, are unlikely to look upon the Gas Industry as a fruitful field for their labours. One cannot live in a city like Birmingham, or any other large city, and not realize that industry and commerce are prepared to offer remuneration to their sales staff and sales managers much in excess of what our own Industry considers adequate for positions of similar responsibility.

If our Industry persists in this policy it will get the men it deserves—probably better than it deserves—but it will not get the best men, and will suffer in consequence.

Publicity.

I would remind you that advertisement—written advertisement—is only one branch of publicity. Its value varies widely with different commodities. It is certainly a very popular form of publicity, and its popularity has increased its price to the point at which other forms of publicity can compete with it for value. A certain amount of advertisement is essential for gas undertaking, but the publicity derived from and linked up with a service policy is of immense importance. The fact that gas is used for a great variety of purposes by widely different classes of people renders its advertisement more difficult rather than less. So long as the gas undertaking subscribes to the British Commercial Gas Association, it is justified in taking a parochial outlook with regard to its advertisements. Every good provincial journal has a large circulation beyond the area of its town of issue. This circulation has to be paid for in its advertisement rates, but is almost a dead loss to the gas undertaking. Specialized advertisements in suburban journals or local publications appealing primarily to a particular section of the community have, therefore, a high value to the gas undertaking, and can often be obtained at a reasonable rate. But a gas undertaking is so dependent on the goodwill of its customers for retaining or increasing sales that all forms of service publicity are of the highest value. An undertaking's reputation for keeping promises, doing good work, giving prompt attention to complaints, employee realiability, can do it as much good as extensive advertisement; and unless all these exist, advertisements serve no useful purpose.

Extension of Markets.

If we ask ourselves wherein lies our best chance of progress I think one of the things that seems most evident to-day is that gas is not getting as much business as it should do among the people who can best afford to pay for its convenience. So far as the automatic consumer is concerned, although this field may not be saturated, we do get a fair share of the weekly budget, but when we come to the well-to-do household we do not find that proportionate increase in the amount of gas used which we have a right to expect. It is a little difficult to see why this should be so. It may be that we have not been bold enough, that we have let the price factor worry us more than it would our customers. Or perhaps in couching our appeals for the majority we have missed the minority. It might pay an undertaking to prepare a list of its wealthiest customers and then set out systematically to double their gas bills.

Our Competitors.

We may be making a mistake in looking upon electricity as our chief competitor in the domestic field. This is far from being the case. Motor cars are our competitors. Wireless, gramophones, tinned food, and all the crowd of modern luxuries that are becoming necessities; these are our competitors.

Motor cars are really potent reducers of gas consumption. With very many people the upkeep of the car seriously affects the spare money available for home comforts, while week-end and evening runs result in less cooking and entertainment in the home.

Central Heating.

More prosperous days will no doubt see an enormous increase in the number of houses with some form of central

heating. I foresee this as one of the first improvements that will take place in the future home. It will be introduced as a convenience, and gas is the only fuel that can make it a real convenience. We shall have to offer special rates, and the regularity of the load will justify these, especially if we can combine it with the heating of service water during off-peak hours and its storage in heavily insulated supply cylinders. I hope to see the demand for central heating so insistent that in new houses we shall have properly built boiler houses that will solve many of our installation problems.

Smokeless Fuel.

Running parallel to this development an enlightened public will also look to the Gas Industry for the supply of a suitable smokeless fuel for domestic purposes. Although we all know that properly graded coke can be satisfactorily used in the home, there are points of difference between it and coal which militate against its universal employment.

Enormous amounts of money have been laid out, both on this side of the Atlantic and in America, in efforts to perfect a process of low-temperature carbonization that will give a good commercial return. Ultimate success may be reached, but we should all give the most careful attention to the production of a suitable domestic fuel by high-temperature carbonization. The Liverpool process so ably described by Mr. Ralph Gibson in his recent paper read before the National Smoke Abatement Society is worthy of the closest investigation. If a fuel possessing the characteristics set out by Mr. Gibson can be successfully marketed by gas-works throughout the country, then the Gas Industry will once more have demonstrated its great service to the community.

Street Lighting.

It is unfortunate that the recent International Illumination Congress should have taken place at a time when all are seeking to effect economies. The prominence given to street lighting by the Press no doubt did much to rouse the interest of the public in the subject. If economic conditions had been normal this would have given many undertakings an opportunity to bring forward local schemes of improved street lighting, but in any case we are sure to see in the not too distant future great improvements and extensions of lighting, especially for arterial roads. The Gas Industry has shown that it is ready and able to make improvements as soon as the opportune time arrives.

Industrial Sales.

When one speaks of the future possibilities of gas, its industrial uses naturally loom large, but this is probably the field where future expansion is most vitally dependent upon price per therm. Birmingham has done, and is doing, its best to promote industrial gas sales, and I am sure our Past-President, Mr. H. R. Hems, will agree that it is the price factor that decides the day. Every reduction in price widens the opportunities for gas immensely. Industry wants gaseous fuel. We have proved we can do the job and do it better than any other fuel, but the manufacturer can only afford to pay a certain amount for the increased convenience and improved results.

It is possible, however, that England's industrial expansion lies not so much in the heavy industries as in specialized processes and new industries. We must not forget that England has always led the world so far as inventive genius is concerned, though she has not always reaped the full benefit of her inventions. Speaking comparatively, her workmen are well educated and intelligent, and it is in those industries that call for special skill on the part of the workman that the English manufacturer is best equipped to meet competition. In such cases it may well be that fuel costs will not represent so large a percentage of final values as they do in the heavier industries, and gas will win the day by virtue of its increased controllability and convenience.

Scottish Junior Gas Association (Eastern District)

The Opening Meeting of the 29th Session of the Association took place in Edinburgh on Saturday, Oct. 3, when Mr. D. Yule, the retiring President, welcomed 45 members.

His first duty, he said, was to announce the loss the Association had sustained by the death, in tragic circumstances, of William Ramage, of Dunfermline, who was killed early in July. As a mark of respect and sympathy the members stood in silence.

The Secretary announced that the North British Association of Gas Managers had decided to affiliate with the Scottish Branch of the Smoke Abatement Society, and would be represented at future meetings.

Mr. D. Campbell, of Kelty, an Hon. Member, then presented Technical Books to Mr. E. Alexander, of Edinburgh, for his paper on "Gas-Works Statistics," and to Mr. A. Morris, of St. Andrews, for his paper on "Dri-Gas."

New President.

Mr. Yule introduced Mr. David N. Garrie, of Burntisland, the new President, and wished him every success during his term of office.

Mr. Garrie thanked the members for their confidence in him. He then presented Mr. Yule with binoculars, suitably inscribed, as a memento of his Presidency of the Association.

PRESIDENTIAL ADDRESS

of David N. Garrie, A.R.T.C.

[Extract.]

Having dealt with the foundation of the Association, Mr. Garrie said:

The Association started in 1904 amidst great enthusiasm, for more than a score of new members were admitted during the first session. The rate of increase naturally diminished during the next three years to some half-dozen per annum. Membership in 1908 was only 70, due to resignations and lapses of membership. After 1908 meetings were held successively in Kirkcaldy, Dundee, and Perth for the benefit of members in these areas. During the war active membership, as might be expected, reached a low ebb—at the annual general meeting in 1918 only 12 members were present—but in 1921 the 100 mark was reached, and we have steadily advanced to our present total of 120.

Apparently, difficulties were early met with. To the sacrifice of Saturday afternoon leisure was added the expense of travelling considerable distances, and on those occasions when an early start was necessary there was some reluctance shown to grant the necessary time off. These handicaps were encountered, I imagine, by all Junior Associations, and it is good to know that circumstances have changed greatly for the better since then. Although instances of niggardly treatment in the matter of "time off" are not unknown, our Seniors, who are nearly all "old Juniors," are predisposed to our organization, and are at some pains to accommodate as many of their Juniors as they can spare at one time. Discussions arise periodically as to the possibility of obtaining travelling expenses from our respective undertakings (these are actually granted by some of the larger undertakings), as only by some such arrangement can apprentices take full advantage of the organization. It is also true that the status and reputation of the Junior Associations have increased with the years; the value of our work is generally admitted, and therefore additional value to the gas undertaking as well as to the individual must result from membership. In 1925 we circularized an appeal for payment of travelling expenses, with the result that more undertakings now contribute in some measure. On the other hand, were this to become general, we would lay ourselves open to the suspicion of cupidity and self-interest, and the generous hospitality and support now so widely extended us might not then be so freely given.

Raising the Status of the Juniors.

Scrutinizing our records, I am impressed by the repeated invitations from English Associations, dating from 1907, to co-operate in attempts to raise the status of the Juniors by amalgamation, affiliation with Senior Associations, and by instituting some educational standard for membership. The Junior Associations undoubtedly have some standing in the Industry, as the official visit of the Vice-President of the Institution of Gas Engineers, and co-operation in the

administration of the Education Scheme would indicate; and membership might reasonably confer associateship of the Senior Associations. In order to strengthen the position, a general amalgamation of the Junior Associations took place about 1916, but our members have stedfastly declined repeated invitations to affiliate, until we have now the undesirable distinction of being the only unit outside the British Junior Gas Association. All the phases of opinion have been faithfully recorded. Disinclination to act in 1907; lack of conviction of benefits to accrue in 1916; reduction of members by membership qualifications, impracticable and undesirable, in 1922; impracticability of meeting expenses involved in 1927; and finally, on our own representative's report from the British Junior Council Session at Glasgow, October, 1929, that membership qualifications would be waived, the desirability of affiliation was recognized, but still the estimated expense was considered beyond our income. I am in agreement with our latest decision, but would point to the present advocacy of amalgamation of all technical organizations connected with the Industry; as an added reason for participation in this movement, and as a solution of the expense difficulty, I would suggest the possibility of joint membership with our confrères of the Western District.

It has been said that the only enduring thing is change, but the form of our syllabus has every appearance of rigid permanence. With the exception of the war years, when Mr. J. J. Scott, of Cowdenbeath, valiantly carried on the affairs of the Association, the established custom is four meetings and four visits yearly.

THE PRESIDENT.

DAVID GARRIE, Burntisland.

Mr. Garrie, who is Assistant Manager to the Burntisland Gas Department, was educated at Edinburgh and Alloa Academy, and became an Associate of the Royal Technical College, Glasgow. In the period 1914-19 he was on war service. Before taking up his present appointment in 1928, Mr. Garrie was with the Cowdenbeath Gas Company, Ltd., and the Glasgow Corporation Gas Department.

The record of repeated visits to the same works makes monotonous reading, scarcely relieved by the knowledge that the personnel of our membership is constantly changing, but sufficiently slowly to allow of several repeat visits being made. Further, the same type of works is visited with even greater frequency, and in my own experience, and previously, no doubt, constant thought is exercised as to how variety may be introduced. We are departing, from the type of visit termed "Inspection of Works," and arranging instead to have them coincide with structural or mechanical alterations, the educational advantage being obvious. Two recent examples were the waterless holder at Granton and the "Dri-gas" process at St. Andrews. Even discussion of ordinary repairs in the course of execution provides a valuable feature of interest, sure to appeal to some section of our members, and not without interest to the others. In short, wherever our knowledge and experience have been enlarged, our visit has been worth while.

Our Association was formed to provide facilities for self-instruction, to which end the presentation of papers by members and discussion thereon have been chiefly directed. No part of our work proves so difficult to arrange, for we cannot discuss profound topics *ad infinitum*, and few of us are engaged in experimental work or in a position to discuss results of such. This is the type of paper, I presume, to be submitted in competition for the Bronze Medal of the Institution of Gas Engineers, but we are dependent for such on the good offices of specialists. We may profitably devote ourselves to workaday problems and difficulties, when each one of us becomes a potential contributor to the general store of knowledge. There is a curious reluctance to embark upon a task of educational effort requiring the expenditure of time and thought, so our immediate past President, Mr. David Yule, found a happy solution four years ago in the introduction of paperettes—short papers of ten minutes' duration on minor subjects—and these have met with general acceptance. It is a remarkable fact that many of these have contained sufficient material for development to a full-length paper. The more elementary subjects generally give rise to lengthy and general debate, being within the comprehension of all, and within our ability of self-expression, which develops with practice. Nevertheless, discussion sometimes flags, and perhaps it would be helpful to consider how discussion may be maintained at a level worthy of us. The stringency of our finances has always prohibited the circulation of advance copies of papers and denies the opportunity of leisurely thought before voicing our opinions, and I would suggest that members be encouraged to send in written comments on papers at a later date as is done by the Institution of Gas Engineers. But each member is notified of the titles of papers to be read, so that some preparation, by reference to one's own records, to standard works, or past papers on the same subject may be made in advance. This procedure enables one to submit constructive criticism from an individualistic point of view.

I often wonder what is the real permanent value of the papers submitted to us year by year. Do we re-read them at our leisure, or when the Transactions are published? The majority of them, being the result of practical experience, have a direct application, and I am aware of only one or two instances where attempt has been made to confirm an author's statements, or to advance the matter a stage further. Otherwise we should have, at subsequent meetings or sessions, continuations of papers previously read, with frequent back references. This would constitute practical experimental research, and in simple form is well within our capability. Results, even though mainly negative, would be of real value to the younger and less experienced members, and would benefit all concerned. Diplomatic presentation of the project, coupled with a disinterested desire for knowledge, would influence our friendly disposed Seniors to grant reasonable facilities for the execution of the work. I gather from the report of the Address recently delivered by Mr. J. D. Smith, of Belfast, to the Waverley Association, that some such independent research has resulted in promising practical trials of a motor fuel derived from coal tar oils.

Mr. YULE expressed his appreciation to Mr. Garrie for bringing to the notice of members the history of the Junior Gas Association in Scotland, and for the able manner in which he had placed the details before them.

Mr. J. RICHMOND (Penicuik) suggested that if the seniors would join the young members occasionally they would find that youthful enthusiasm so essential to the Gas Industry to-day.

Mr. W. C. SPENCE (West Wemyss) said he was glad that the Senior Association had decided to affiliate with the Smoke Abatement Society, for the Gas Industry held the key to the smoke problem.

Mr. GARRIE thanked the members for their appreciation of his Address. He then called upon Mr. Rea to read his Diploma Thesis—The Construction of a 5 million c.ft. Waterless Gasholder—which was awarded the Charles Hunt Memorial Medal for 1931, and congratulated him on bringing this honour to the Eastern Juniors for the first time.

Progress of Pipe Joint Research

By K. R. KNAPP, Chief Engineer, American Gas Association Testing Laboratory, Cleveland, Ohio

[A Contribution to the Distribution Conference of the American Gas Association, April, 1931]

(*Continued from Vol. 195, p. 544.*)

VALUE OF PNEUMATIC HAMMER FOR CEMENT DRIVING.

A number of cement, as well as cement and sand, joints were prepared in No. 2 bells, and tested. The results in all cases were distinctly unsatisfactory except in one instance where a pneumatic hammer was used for driving the cement. This particular joint gave performance far superior to any of the others tested. This was probably due to the more effective compression of the cement which it was possible to obtain by use of the air hammer. However, only one such joint was found to give this performance. A second, while proving much better than the other joints made by the use of hand tools, was still much less satisfactory than the first, while a third showed no improvement whatever.

Cast lead joints made up by hand caulking were also found to be unsatisfactory. Some difficulty was encountered in securing an initial tightness under a static pressure test before any loading had been applied. After a few reversals, leakage was found to occur even on a test pressure of 10 in., which was the lowest used. A few joints were prepared using cast lead caulked by the air hammer, but their performance was also unsatisfactory. Lead wool, on the other hand, air caulked, gave much better results and in a few instances such joints remained tight practically to the end of the test cycle. It was found that the method of preparation of such joints exerted a considerable influence on their test performance, as joints prepared by one particular method were found much inferior to those by which the majority were made up.

Several samples of combination joints were prepared in which cement was placed in the lower part of the joint space and driven with a rope of yarn upon which a 1¼ in. layer of lead was cast and caulked. These were found to give much better results than obtained from the use of either cement or lead alone in the joints previously mentioned. An extension of this method was tried by using cement followed by lead wool, which proved still more satisfactory.

A few joints were also prepared in which a two-piece rubber ring was caulked in place upon a layer of square-braided jute which had first been tightly driven by an air hammer. The space above the rings was then filled with lead wool also caulked by air. Everything considered, these joints gave the most satisfactory results.

During the progress of these tests, it was found that several spigot pieces fractured at the point of juncture of the pipe with the flange. This breakage was thought due mainly to the machining of the face of the flange too close to the pipe. It is quite likely that some excessive strain may have been set up at this point in the process of casting and that the removal of a certain amount of metal in machining weakened the specimen to such an extent that it could not withstand the loads which it was called upon to meet. It is worthy of mention that all cases of breakage occurred when the higher loads were applied in the latter portion of the testing cycle.

Shortly before conclusion of the work, extra spigot specimens were ordered from the foundry, in which the pipe wall was materially increased at the point where breakage had occurred. No further trouble was encountered with breakage on these specimens.

The results of the work on large pipes are not as yet complete. It is felt that some further experiments are warranted on the combination type of joint, as it was not possible to carry the tests to completion on any of the specimens of this type on account of the pipe breakage previously mentioned. In addition to this, it also seems desirable to obtain some information on the performances of rubber rings held in place by cement. Some preliminary work was done on this type of joint but the information to date is quite incomplete.

One point which can be brought out from the results of the tests which have already been made is the distinctly poor performance given by cement joints which is decidedly inferior to that secured from the same type of joint in smaller sizes. The same may be said to a large extent for the cast lead joints which were tested, and it seems logical to state that any difficulties which have been experienced in joints of this kind in smaller sizes are likely to be much increased when they are used in pipe of large diameter. It may also be mentioned that the various tests brought out quite definitely some of the advantages which may be secured by the use of pneumatic caulking in contrast to hand caulking. This appears to be of particular advantage in the case of large joints.

(*To be continued.*)

REGISTER OF PATENTS

Piston Level of Waterless Holders.—No. 354,444.

GAS LIGHT AND COKE COMPANY, of Horseferry Road, S.W. 1, and MILLS, F. E., of Brentford.

No. 16,657; May 29, 1930.

This invention relates to clinometric apparatus of the kind in which the movement of an electrically conductive mobile liquid confined in a holder over contact terminals closes an electric circuit or circuits so as to give an indication of the tilt of the apparatus to which the holder is attached, and is more particularly intended for use in connection with waterless gasholders, for the purpose of verifying the proper level condition of the piston.

The present method of verifying that the piston in a waterless holder is horizontal consists in periodically inspecting and subsequently comparing the level of sealing oil between the piston edge and the inside face of the holder shell with some predetermined datum or point usually on the piston itself, such levels being generally determined at the four cardinal points of the piston on the assumption that the sealing oil will flow by gravity to the lowest point of the piston and so give a greater depth of sealing oil at that particular point. Such a method necessitates a personal determination and inspection by an operator at such intervals apart as are deemed necessary. These intervals will obviously be as long apart as possible consistent with safety, on account of the difficulty of access to the piston. Further, should for any reason undue thickening of the sealing oil take place, some time may elapse between tilting of the piston and the accumulation of the sealing oil at the lowest point.

This invention has for its objects to obviate the disadvantages inherent in the aforesaid method, and to provide means to indicate audibly and/or visibly, and exteriorly of the holder (preferably at a point remote therefrom), when the piston is out of the horizontal.

The electrically conductive mobile liquid, which is disposed in a shallow concave dish of insulating material, is adapted to co-act with a plurality of circularly arranged continuous or interrupted electrically conductive strips mounted on the inner surface of the dish so that the electrically conductive liquid, on displacement due to tilt of the piston to which the dish is applied, closes an electric circuit or circuits which include audible graphic and/or visible indicating means so as to give an indication that the piston is out of the horizontal. The electric contact terminals may be so arranged as to give not only an indication of tilting of the piston, but also an indication of the direction of tilt, with or without an indication of the magnitude of the tilt and, if desired, an indication when a dangerous tilt has been reached.

Coke Grading Apparatus.—No. 354,709.

BROADHEAD, R. W., of Ashton-on-Mersey.

No. 11,117; April 8, 1930.

This invention comprises a screening surface consisting of rotating bars or rollers having spaces between them of the requisite size to pass the predetermined sizes of material to be screened from the bulk, the bars or rollers all rotating in the same circular direction and causing a gentle lifting and lowering

of the materials as it is traversed along the screening surface by the rotation of the rollers.

The rollers, which may be of circular, square, hexagonal, cruciform, or other suitable shape in cross-section, are journalled in side plates and intergeared by suitable means which cause the rollers to rotate in the same circular direction. The gearing may be contained within a cover.

The rollers are at such a distance apart as to provide for the passage through between them of material of predetermined fineness, the remaining material being carried forward along the machine, due to the rotation of the rollers. If desired, the screening surface formed by the rollers may provide for the separation of materials of gradually increasing size. This is accomplished by varying the spacing of the rollers.

Camborne Gas Company.

The Annual General Meeting of shareholders of the Camborne Gas Company, Ltd., was held recently—the Chairman of Directors (Mr. S. J. Ingram) presiding.

The report of the Directors stated that the acute economic depression which had persisted during the past year had caused a reduction in the use of gas for industrial and power purposes, but this reduction had been almost counterbalanced by a greatly increased quantity of gas supplied for private and domestic purposes, particularly through automatic meters. During the year 33 new consumers were connected to the Company's mains, and the average consumption of gas per meter had greatly increased largely owing to the increasing popularity of gas for cooking and heating. The balance standing to the credit of profit and loss account, amounting to £3738, the Directors recommended should be appropriated as follows: Dividend at the rate of 5 p.ct. per annum (less income-tax thereon), £736; carried to next account, £3002; total, £3738. In the course of his address the Chairman said: I am sorry to report a slight decrease in the total quantity of gas sold during the past year, but this has been almost entirely due to the reduced demand for gas by one of our large power users. I am glad, however, to add that this has been partially offset by an increase in the use of gas by private consumers. Gas supplied through ordinary meters increased by 60,000 c.ft., and that supplied through automatic meters by over half a million c.ft.—a striking tribute to the increasing popularity of gas in the home for lighting, heating, and cooking.

Deal Company's Annual Meeting.

The Annual General Meeting of the Deal and Walmer Gas Company was held at the office at the works, Cannon Street, Deal—Mr. G. T. HANNAFORD (Chairman) presiding.

The CHAIRMAN, dealing with the various points arising from the accounts, said: The item, "new buildings &c.," of £9805, on the debit side of the capital account, represents part of the expenditure in connection with the new retorts. The item, "new showrooms," at £5950, is, as the report indicates, explained by the acquisition of the freehold, which the Directors consider a satisfactory investment. New mains and service pipes have called for an expenditure of £1360, as against £2089, a decrease of £729, for the previous year; while new meters at £521 shows a decrease of £379, and new stoves a decrease of £48 on the previous year.

Turning to the revenue account, on the debit side the expenditure on coal shows a small reduction of £28, although the amount of coal carbonized was some 46 tons higher than the previous year. The expenditure on repairs and maintenance at £4503 shows a reduction of £336 on the previous year. On the credit side of the revenue account, the sale of gas at 875,856 therms shows an increase of 22,747 therms, equal to 2·6 p.ct., the monetary increase amounting to £918. The revenue from coke and breeze shows an increase of £609, while tar shows a reduction of £811 and sulphate of ammonia of £16, the net result of the income from residuals being a reduction of £107, compared with the previous year, chiefly due to the fall in the market price of tar.

The gross revenue account shows a credit balance of £8843, as against £8705 for the previous year. The net revenue account shows a balance of £3391, as against £4619 for the previous year, the reduction being due to income-tax adjustments.

The Chairman moved that the dividends on the 6½ p.ct. preference stock and a dividend of 7¾ p.ct. on the ordinary stock be paid, less the interm dividend already paid, and less income-tax.

Leamington Priors Gas Company.

The 133rd Ordinary General Meeting of the shareholders of the Leamington Priors Gas Company was held at the Gas-Works on Tuesday, Sept. 29. The CHAIRMAN (Dr. Harold Mason, J.P.) presided.

The notice of the meeting and the minutes of the previous meeting having been disposed of, the CHAIRMAN congratulated the shareholders on the increased sales of gas both for the six months and for the twelve months ended June, 1931, compared with the corresponding periods a year ago. This result was particularly satisfactory in view of the economies which the public were having to exercise. The returns from tar and sulphate of ammonia were down, unfortunately. The price of tar had dropped, and the production and sale of sulphate of ammonia had been carried on at a loss, although the ammoniacal liquor had to be disposed of.

It was rather interesting that a comparison of the census figures with those for the sales of gas showed that during the last ten years the population of Leamington had increased 2½ p.ct., while the sale of gas had increased 19 p.ct. During the last fifty years the population had increased 29 p.ct. and the sales of gas within the borough had increased three and one-third times.

The Board were very pleased at the keen interest shown by their younger employees in the work at the evening classes which they attended. Seventeen successes had been obtained at the practical and theoretical examination held last April under the auspices of the Institution of Gas Engineers.

The Chairman then moved the adoption of the accounts and of the report, recommending the payment of the statutory dividends.

This was seconded by Dr. HAYNES.

Dr. MASON then presented the prizes and certificates to the successful students in the City and Guilds of London Institute Examination, and a vote of thanks, acknowledged by the CHAIRMAN, concluded the meeting.

Municipal Gas Undertakings' Results in 1930-31.

GLASGOW.

The quantity of coal carbonized during the past year was 578,432 tons, as compared with 581,278 tons for the preceding year, a decrease of 2846 tons. The average cost of coal carbonized last year was 17s. 5·692d., being a decrease of 0·037d. over the preceding year. The quantity of coal gas made per ton of coal carbonized was 14,969 c.ft., which, with water gas, gave an average of 15,482 c.ft., as compared with 14,761 c.ft. and 15,256 c.ft. respectively per ton for the previous year. The quantity of gas delivered and accounted for during the year amounted to 8,776,404,482 c.ft., as compared with 8,977,854,915 c.ft. for the preceding year, a decrease of 201,450,433 c.ft., equal to 2·2 p.ct. The unaccounted-for gas during the year was 9·5 p.ct., as compared with 7·2 p.ct. for the preceding year. The net sum realized from the sale of coke this year amounts to £164,127, being £11,309 less than that of the preceding year. The total quantity of coke sold this year was 223,990 tons, compared with 293,964 tons for the previous year, a decrease of 69,974 tons. The number of ordinary meters in use on May 31 last was 200,955, as compared with 203,528 for the preceding year, a decrease of 2573. The number of prepayment meters in use on May 31 last was 118,716, as compared with 113,651 for the preceding year, an increase of 5065, giving a net increase of 2492 meters.

HEYWOOD.

The gross revenue amounted to £32,542, and the gross expenditure (less interest and sinking fund) to £24,260, leaving a gross profit of £8281, and, including £8384 interest and sinking fund, a net loss of £102. In comparison with the figures for the preceding year the gross income is decreased by £1832, and the gross expenditure by £1856, while the net revenue charges, chiefly on account of higher sinking fund contributions, are increased by £194. The loss of £102, comparing with a profit of £68 in 1930, will, no doubt, be considered as satisfactory by the Committee when bearing in mind the heavy decrease in revenue. The total capital expended during the year amounted to £1039. The total of gas manufactured was 688,635 therms, of which 107,032·5 therms was carburetted water gas; 7195 tons of coal were carbonized giving an average make per ton of 80·83 against 81·58 therms last year. The total sales of gas for the year have amounted to 607,745·65 therms, as compared with 632,191·05 therms in 1930, a decrease of 3·86 p.ct. The net profit this year is brought down to £243, and the gas consumers have benefited considerably with the lower price prevailing. The gross profit was £13,789, and interest on loans absorbed £6829, and sinking fund contributions took £6716, these two items representing a charge of 24·63d. per 1000 c.ft. gas sold.

NOTTINGHAM.

The net profit amounted to £57,780, which, with a balance brought forward from the previous period, rendered £79,347 available for distribution in amplification of reserve funds, and a percentage proportion in relief of the rates. The balance to be carried forward to next year is £46,605. The cost of the criminal poceedings against prisoners who were involved in defrauding the Department, after allowing for certain recoveries, amounted to £5700. Subsequent to the close of the financial year further recoveries totalling £6835 had been made, and would be brought into the next accounts, further claims being still pending. A contract has been entered into by the Gas Committee with the Notts. and Derby Coke and Bye-Products Company for a supply of gas not exceeding 2 million c.ft. per day, the supply commencing on April, 1931, 11 miles of 12-in. diameter high-pressure mains being laid between the Company's works at Pinxton and the Basford depôt of the Corporation. Despite severe trade depression and keen competition from electricity, the sale of gas shows an increase of 24,247,100 c.ft.

GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

The uncertainty with regard to the political situation was to a large extent dispelled last week by the decision to hold the General Election, and the news was received by the Stock Exchange with feelings of considerable relief. That many investors are confident in the result was evidenced by the increasing number of buying orders, particularly of Government stocks and the better-class industrials, with the result that a marked increase in quotations was experienced in these sections.

Business in the Gas Market was well up to normal, and as a consequence of the general improvement in tone a partial recovery in value occurred in several securities which had been marked down during the previous two weeks. Among these were the three debenture stocks of the Gas Light and Coke Company and South Metropolitan ordinary, the latter by 2 points to 99½. A sharp rise of 4 points to 159½ was recorded by Harrogate 10 p.ct. maximum stock, and Imperial Continental, after fluctuating during the week, finally closed 5 points up at 345. The week was not without its reverses, however, and Wandsworth 5 p.ct. preference fell 3 points to 92, though one parcel of stock changed hands on Wednesday at 98¾. Commercial 3 p.ct. debenture also dropped 3 to 54½; while (at the local Exchange) Newcastle £1 units declined 6d. to 15s. 9d., and South Shields consolidated weakened 2 to 109.

The Directors of the Imperial Continental Gas Association have declared an interim dividend of 7½ p.ct., less tax, on the £2,800,000 capital stock, payable on Nov. 13. The dividend a year ago was at the same rate.

Current Sales of Gas Products.

The London Market for Tar and Tar Products.

LONDON, *Oct.* 12.

The values of tar products generally remain unchanged, but owing to the alteration in exchange values, the price of pitch has advanced to 60s. to 65s. per ton f.o.b.

Creosote, for export, varies from 3¾d. to 5d. per gallon f.o.b., according to specification.

White spirits are as follows: Pure toluole, 1s. 11d. to 2s. per gallon; pure benzole, about 1s. 5d. per gallon; 95/160 solvent naphtha, about 1s. 5d. to 1s. 6d. per gallon; and pyridine bases, 3s. 3d. to 3s. 6d. per gallon.

Tar Products in the Provinces.

Oct. 12.

The average prices of gas-works products during the week were: Gas-works tar, 21s. to 25s. Pitch—East Coast, 52s. 6d. to 53s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 52s. 6d. to 53s. 6d. f.o.b.* Toluole, naked, North, 1s. 8d. to 1s. 8¼d. Coal-tar crude naphtha, in bulk, North, 5d. to 5¼d. Solvent naphtha, naked, North, 1s. 3d. to 1s. 3½d. Heavy naphtha, North, 11d. to 11½d. Creosote, in bulk, North, liquid and salty, 3¼d. to 3½d.; low gravity, 1¼d.; Scotland, 3¼d. to 3½d. Heavy oils, in bulk, North, 5d. to 5½d. Carbolic acid, 60's, 1s. 6d. to 1s. 6½d. Naphthalene, £9 to £10. Salts, 50s. to 70s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Oct.* 10.

While markets are being watched very carefully there is not any great activity, principally on account of the shortage of prompt supplies. Refined tar continues very scarce in this area.

Pitch.—Value remains steady at 45s. to 47s. 6d. per ton f.o.b. Glasgow for export. Home trade is dull at 42s. 6d. per ton f.o.r. makers' works.

Refined tar to Ministry of Transport Specification remains nominal at 2¾d. to 3d. per gallon f.o.r. naked, there being a shortage for prompt.

Creosote oil is again commanding more attention, and prices are firm. B.E.S.A. Specification is 2¾d. to 3d. per gallon; low gravity, 3¼d. to 3½d. per gallon; and neutral oil, 3¼d. to 3½d. per gallon—all *ex* works in bulk.

Cresylic.—Market is dull, although distillers are hopeful of a recovery in the near future. Pale, 97/99 p.ct., is 1s. 3d. to 1s. 4d. per gallon; dark, 97/99 p.ct., 1s. 2d. to 1s. 3d. per gallon; and pale, 99/100 p.ct., 1s. 5d. to 1s. 6d. per gallon—all f.o.r. in buyers' packages.

Crude naphtha.—Supplies are scarce, and 4½d. to 5d. per gallon is being obtained for best makes.

Solvent naphtha.—Few orders are being received, and quotations are unchanged; 90/160 being 1s. 3d. to 1s. 4d. per gallon, and 90/190 1s. to 1s. 1d. per gallon.

Motor benzole.—Production is low, with value round 1s. 3d. to 1s. 4d. per gallon in bulk f.o.r. works.

Pyridines.—90/160 grade is 2s. 9d. to 3s. per gallon, and 90/140 grade 3s. to 3s. 3d. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.	
Crude benzole	0	7	to	0	7½	per gallon at works
Motor "	1	2	"	1	3	" " "
Pure "	1	6	"	1	7	" " "

Trade Notes.

Joseph Taylor Saturators.

Messrs. Joseph Taylor (Saturators), Ltd., of Blackhorse Street Mills, Bolton, have received orders for two light saturators—one for the Burgh of Falkirk Gas Department and one for the Brechin Gas Company.

Spiral Holder for Bristol.

The Bristol Gas Company have placed an order with Messrs. Edward Cockey & Sons, Ltd., Frome, for a three-lift spiral-guided gasholder, having a capacity of 670,000 c.ft., to be erected in an existing tank at their Canon's Marsh Works.

Wilson's Meters.

In order to cope with their increasing business, the Coventry works of Messrs. George Wilson Gas Meters, Ltd., have been considerably enlarged and modernized. A meter with an entirely new principle of working the valve mechanism will shortly be placed on the market.

Firth Blakeley Gasholder Contracts.

Messrs. Firth Blakeley, Sons, & Co., Ltd., of Church Fenton, have secured orders for a new spiral-guided gasholder and steel tank for the Thame Gas and Coke Company, and another for the Princes Risborough Gas Company. In each case the "Vulcan" ball bearing spiral carriages, made by the firm, are specified.

Contracts Advertised To-Day.

Condensers.

The Clacton Urban District Council Gas Department invite tenders for the supply of annular and water cooled condensers. [Advert. on p. 162.]

Purifiers.

The Clacton Urban District Council Gas Department invite tenders for the supply of cast-iron purifiers. [Advert. on p. 162.]

Advice Has Been Received by Cable from the Head Office of the Colonial Gas Association, Ltd., in Melbourne, respecting the operations of the Association during the year ended June 30, 1931. After providing for depreciation, &c. (states the Directors' report), the balance at credit of revenue account is £111,085. Adding the balance brought forward from last year—viz., £19,124—and deducting bank, loan, and debenture interest and after payment of interim dividend of 4 p.ct. and 3½ p.ct. for the half-year ended Dec. 31, 1930, paid in April last on the preference and ordinary shares respectively, the amount at credit of the net revenue account is £66,825. The Directors recommend that a dividend at the rate of 8 p.ct. per annum (less interim dividend of 4 p.ct. for the half-year ended Dec. 31, 1930) be paid on the preference shares; that a dividend at the rate of 6½ p.ct. per annum (less interim dividend of 3½ p.ct. for the half-year ended Dec. 31, 1930) be paid on the ordinary shares; that £13,800 be set aside for Australian Income-Tax on profits earned to June 30, 1931; and that the balance, approximately £22,458, be carried forward to the next account. The sales of gas show a decrease of 10·9 p.ct. on the sales for the preceding year, and the sales of gas for the subsidiary companies a decrease of 7·3 p.ct. This is attributable to the general depression in Australia.

STOCK AND SHARE LIST.

[For Stock Market Report, see earlier pages.]

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Oct. 10. (Provincial Exchanges Oct. 9.)	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
£			% p.a.	% p.a.				
1,551,868	Stk.	Oct. 5	7⅞	7⅞	Alliance & Dublin Ord. ...	100—105*	−2	103—107
374,000	,,	July 9	4	4	Do. 4 p.c. Deb. ...	67—72	...	...
522,655	,,	Aug. 24	7	7	Barnet Ord. 7 p.c.	121—126	...	...
300,000	1	Apl. 23	1/4⅛	1/9⅜	Bombay, Ltd.	15/—17/6	...	...
174,500	10	Aug. 10	9	9	Bournemouth 5 p.c. ...	14⅜—15⅜	...	...
500,050	10	,,	7	7	Do. B 7 p.c. ...	12—13	...	...
439,160	10	,,	6	6	Do. Pref. 6 p.c. ...	10¼—11¼	...	10⅜—11⅛
50,000	Stk.	June 25	3	3	Do. 3 p.c. Deb. ...	55—60	...	...
162,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	75—80	...	...
357,900	,,	Aug. 24	7½	7½	Brighton & Hove 6 p.c. Con.	114—119	...	107
371,880	,,	,,	6½	6½	Do. 5 p.c. Con.	104—107	...	...
1,287,500	,,	July 23	5	5	Bristol 5 p.c. max.	90—93[a]	...	...
120,420	,,	June 25	4	4	Do. 1st 4 p.c. Deb. ...	78—80[a]	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	78—80[a]	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	98—99[a]	...	...
865,000	,,	Oct. 5	8	7	British Ord.	107—112*	−3	108½—109½
100,000	,,	June 25	7	7	Do. 7 p.c. Pref.	110—115	...	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	70—80	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	90—100	...	...
160,000	,,	June 25	5	5	Cambridge 5 p.c. Deb. ...	95—100	...	...
100,000	10	May 21	6	8	Cape Town, Ltd.	9—10	...	...
100,000	10	May 7	4½	4½	Do. 4½ p.c. Pref. ...	6½—7½	...	...
150,000	Stk.	June 25	4½	4½	Do. 4½ p.c. Deb. ...	65—70	...	...
636,860	,,	July 23	6	6	Cardiff Con. Ord.	95—98	...	...
237,860	,,	June 25	—	2⅜	Do. 5 p.c. Red. Deb.	90—100	...	...
167,150	,,	Aug. 10	6⅛	5	Chester 5 p.c. Ord.	85—90[b]	...	...
98,936	1	Oct. 5	1/2/-	2/-	Colombo, Ltd. Ord.... ...	27/—32/*	−1/-	...
24,500	1	,,	1/4⅛	1/4⅛	Do. 7 p.c. Pref.	17/—19/*	−/6	...
669,204	1	Apl. 9	1/4⅛	15·27[d]	Colonial Gas Assn. Ltd. Ord.	10/—15/-	...	...
296,053	1	,,	1/7⅛	17·67[d]	Do. 8 p.c. Pref.	10/—15/-	...	...
2,073,280	Stk.	July 23	6	6	Commercial Ord.	92—95	...	...
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. ...	52—57	−3	...
787,560	,,	Aug. 10	7	7	Croydon sliding scale	107—110	...	107½—109½
453,100	,,	,,	5	5	Do. max. div.	81—84	...	82½—83½
542,270	,,	Aug. 24	10	7	Derby Con.	120—125*	...	...
55,000	,,	June 25	4	4	Do. Deb.	65—70*	...	...
209,000	,,	Sept. 7	5	5	East Hull Ord. 5 p.c. ...	70—73	...	...
1,002,180	,,	Sept. 21	16½	14	European, Ltd.	100—110	−2	102—115
18,953,033	,,	July 23	5⅝	5⅝	Gas Light & Coke 4 p.c. Ord.	18/3—19/3*	...	18/4½—19/-
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	52—62	...	55—60
4,294,691	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	68—78	...	69—73
5,694,095	,,	June 11	3	3	Do. 3 p.c. Con. Deb. ...	54—59	+1½	54½—58½
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	93—98	+½	94—96
2,500,000	,,	,,	—	4½	Do. 4½ p.c. Red. Deb. ...	87—92	+2	85—90
161,480	,,	Sept. 7	10	10	Harrogate Cons. 10 p.c. max.	157—162	+4	160½—161
82,500	,,	Aug. 24	7	7	Hastings & St. L. 5 p.c. Conv.	95—100*	...	...
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	80—85	+1	...
70,000	10	Oct. 9	⅛	10	Hongkong & China, Ltd. ...	12⅛—13⅛	...	...
213,200	Stk.	Aug. 10	6	6	Hornsey Con. 3½ p.c. ...	89—92	...	...
2,800,000	,,	May 21	15	25	Imperial Continental Cap.	335—355	+5	337—352
223,130	,,	Aug. 10	3½	3½	Do. 3½ p.c. Red. Deb.	70—75	...	...
285,242	,,	Aug. 10	8½	8½	Lea Bridge 5 p.c. Ord. ...	129—132	...	...
2,145,907	,,	Aug. 24	6	6	Liverpool 5 p.c. Ord. ...	94½—95½*	...	...
306,083	,,	July 15	4	4	Do. 4 p.c. Deb. ...	79—81*	...	...
165,736	,,	Aug. 24	9	8	Maidstone 5 p.c. Cap. ...	127—132	...	...
63,480	,,	June 25	3	3	Do. 3 p.c. Deb. ...	55—60	...	...
75,000	5	June 11	110	110	Malta & Mediterranean ...	6¾—7½	...	...
392,000	—	Oct. 1	5½	5½	Metropolitan (of Melbourne)	78—83*	...	...
171,978	Stk.	Aug. 24	5	5	5½ p.c. Red. Deb.	76—81	...	...
522,992	,,	,,	4	4	M. S. D. Utility "C." Cons.	73—78	...	...
675,000	,,	May 21	16	16	Do. 4 p.c. Cons. Pref.	80—90	...	...
2,061,315	,,	Aug. 10	5⅝	5	Montevideo, Ltd.	15/3—16/3[d]/	−/6	...
682,856	,,	,,	4	4	Newcastle & Gateshead Con.	74—75[d]	...	...
691,705	,,	June 25	3½	3½	Do. 4 p.c. Pref. ...	69—71[d]	...	...
277,285	,,	May 7	5	5	Do. 3½ p.c. Deb. ...	98—100[d]	...	...
199,940	,,	Aug. 24	7½	7½	Do. 5 p.c. Red. Deb.	105—110	...	...
396,160	,,	Aug. 10	5	5	North Middlesex 6 p.c. Con.	74—79	...	...
300,000	,,	Apl. 23	9	7	Northampton 5 p.c. max. ...	93—103	...	...
60,000	5	13 May, '15	—	—	Oriental, Ltd.	0—½	...	...
205,162	Stk.	June 25	8	8	Ottoman	110—115	...	...
424,416	,,	Aug. 24	8	8	Plym'th & Stonehouse 5 p.c.	119—124	...	...
241,446	,,	,,	5	5	Portsm'th Con.Stk. 4 p.c.Std.	76—79	...	...
686,312	,,	July 23	4	4	Do. 5 p.c. max. ...	83—86	...	84½—84½
389,813	,,	June 25	4	4	Primitiva 4 p.c. Rd. Db. 1911	84—87	...	84½—84½
150,000	10	Sept. 21	6	6	Do. 4 p.c. Cons. Deb.	74—8*	...	78—7½
1,736,968	Stk.	Sept. 7	6½	6	San Paulo 6 p.c. Pref. ...	103—105*	...	...
95,000	,,	July 9	4	4	Sheffield Cons.	79—81[e]	...	...
133,201	,,	Sept. 7	5	8½	Do. 4 p.c. Deb.	72—77	...	...
90,000	10	June 11	15	15	Shrewsbury 5 p.c. Ord. ...	3½—5½	...	...
6,709,895	Stk.	July 23	7½	5	South African	97—102	+2	97—100½
1,135,812	,,	,,	6	6	South Met. Ord.	100—110	...	100—102
1,895,445	,,	July 9	3	3	Do. 6 p.c. Irred. Pf.	54—59	−1	55—57
1,000,000	,,	July 23	4	5	Do. 3 p.c. Deb. ...	90—100	...	...
91,500	,,	Aug. 10	8½	8½	Do. 5 p.c. Red. Deb.	108—110[d]	−2	...
1,543,795	,,	Aug. 10	6½	6½	South Shields Con.	101—104	...	101½
668,837	,,	June 25	5	5	South Suburban Ord. 5 p.c.	90—100	...	92
647,740	,,	Aug. 24	5	5	Do. 5 p.c. Deb.	76—79	...	73½
121,275	,,	June 25	4	4	Southampt'n Ord. 5 p.c. max.	70—80	...	...
250,000	,,	Aug. 24	7	7	Do. 4 p.c. Deb.	95—98	...	96
200,000	,,	June 25	6½	6½	Swansea 7 p.c. Red. Pref. ...	99—102	...	...
1,076,490	,,	Aug. 10	6⅜	6½	Do. 6½ p.c. Red. Deb.	103—107	...	102—105
150,000	,,	,,	5⅜	5⅜	Tottenham and District Ord.	99—102	...	...
199,005	,,	June 11	4	4	Do. 5½ p.c. Pref. ...	70—80	...	...
85,701	,,	Sept. 21	6	6	Do. 4 p.c. Deb. ...	72—77*	...	...
310,694	,,	Aug. 24	7	7	Tuscan, Ltd., 6 p.c. Red. Db.	100—105	...	102
88,380	,,	,,	5	5	Uxbridge, Maidenhead, & Wycombe 5 p.c.	88—93	...	...
1,322,220	,,	July 9	7	7	Do. 5 p.c. Pref. ...	111—114	...	111⅞
971,373	,,	,,	5	5	Wandsworth and District: Consolidated	87—97	−3	92—98⅜
1,167,964	,,	June 25	5	5	Do. 5 p.c. Pref.	90—100	...	92½—94
					Do. 5 p.c. Deb.			

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of stock. * Ex. div. † Paid free of income-tax. ‡ For year. ‖ Div. = 10 p.ct. p.a. less tax and less tax on interim dividend.

RECOVER WASTE HEAT

with

up-to-date plant costing the least to install and effecting MAXIMUM RECOVERY.

Better recoveries are now obtainable than ever before, and the best recoveries yet obtained have been achieved by designs made by the Principal of this Firm.

THESE RECOVERIES ARE:

5¾ lbs. STEAM from and at 212° F. per lb. of coke put into the producers to heat VERTICAL RETORTS

and

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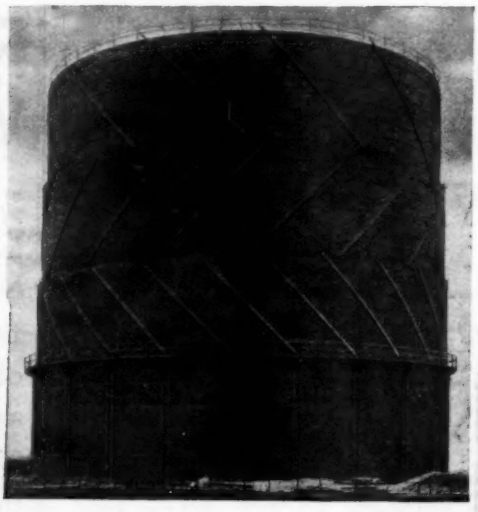

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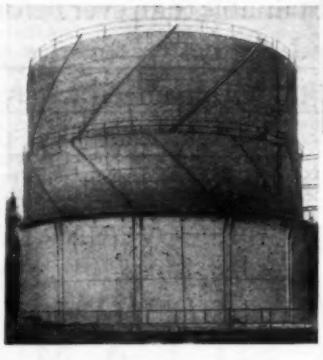

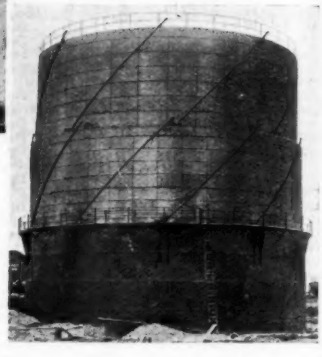

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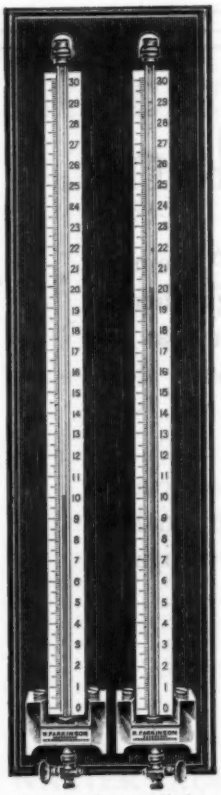

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